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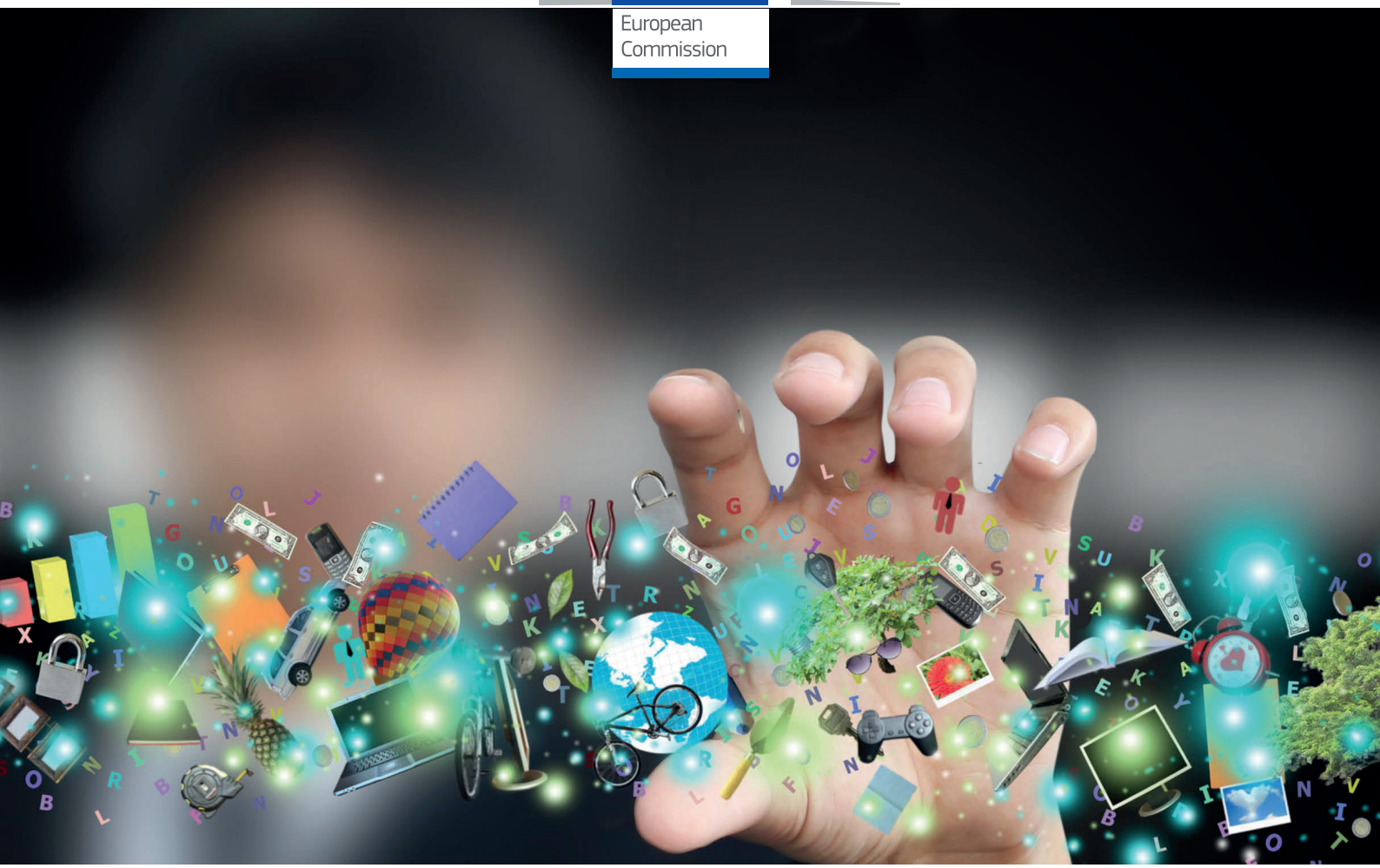

The Digital Agenda Toolbox

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The Digital Agenda Toolbox

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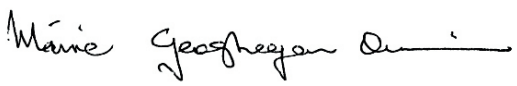
Preface

The EU has just agreed its new budget framework for the next seven years: giving a sound basis for the EU, its countries and regions to invest in tomorrow's growth, stimulating innovation and improving the lives of citizens.

Countless studies show that broadband infrastructure and Information and Communications Technologies (ICT) drive growth, create jobs and richly reward investment. So investing in these areas through the European Structural and Investment Funds (ESIF) would be a promising way to energise the European economy. Indeed, ICT do not just contribute to a significant proportion of overall productivity growth but also makes up one quarter of total R&D business. ICT research and innovation are therefore simultaneously the key to a more competitive, inclusive and robust Europe – something our Horizon 2020 programme can ably stimulate and reinforce.

Despite these advantages, it is not always easy for countries or regions to identify the tools available or capture the opportunities on offer. This Toolbox, a joint effort between the European Commission's DG CONNECT and the Joint Research Centre's Institute for Prospective Technological Studies (IPTS) in conjunction with the Smart Specialisation Platform, intends to help overcome this by assisting EU Member States and regions to prepare their ESIF strategies and operational programmes. It provides information and best practice examples in different areas of ICT—which could be used as paradigms, both for EU financing, and attracting other kinds of investment, through national or regional Smart Specialisation Strategies.

The Toolbox is not a static document written in stone. It is a dynamic and continuously evolving tool. In particular, your feedback can improve it. So please make good use of it – and we hope you will share your experiences with us!



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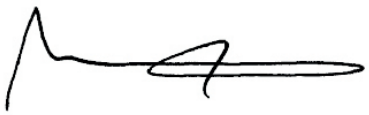

Neelie Kroes

Contents

1. Introduction

This Toolbox aims to help regional and national authorities to develop a better understanding of the digital growth potential of the Digital Agenda for Europe (DAE)[1]. It highlights the crucial importance of incorporating Information and Communication Technologies (ICT) in national or regional research and innovation strategies for smart specialisation (RIS3) and Operational Programmes (OPs). It also gives guidance for the fulfilment of the DAE-related conditions (the 'ex-ante conditionalities') for using European Regional Development Funds (ERDF) for ICT investment. It thus complements the RIS3 Guide[2], the Guide on Broadband Investment[3] and other related policy documents.

The Toolbox provides hands-on assistance for developing a strategic policy framework for digital growth and gives examples of good practices. Strategies for digital growth can build on an ICT-specific policy framework that encompasses one or several documents; it can be a standalone document or may be incorporated in broader research and innovation strategies. Regardless of which option is chosen, this Toolbox provides guidance on how to design a policy framework to reinforce competitiveness, improve social, economic and territorial cohesion while contributing to the objectives set out within the Digital Agenda for Europe and National Reform Programmes.

The Toolbox consists of three parts:

- Linking the Digital Agenda and European Structural and Investment Funds for 2014-2020;
- Identifying common themes in developing a policy framework;
- Giving guidance on smart investment in ICT infrastructure, measures to support the development of ICT services, applications and products, and ICT up-take.

The Toolbox has been prepared by the European Commission, in particular, the Smart Specialisation Platform of the Joint Research Centre and DG CONNECT. Valuable comments in the preparation phase came from Olivier Brunet, Nivelin Noev, Marco Pino, Ulf Grindgärds, Laura Savini, Giovanni D'Angelo, Bagdi Ferenc and representatives from Falmouth University.

Broader policy context

ICT "cover all technical means used to handle information and aid communication. This includes computer and network hardware, as well as their software".[4] They are powerful drivers for economic growth, innovation and increased productivity. Internet connectivity has dramatically increased the potential for ICT-driven growth. Two billion people are now connected and, by 2016, there will be more than 3 billion Internet users, almost half of the world's population. The 2010 Digital Competitiveness Report showed that ICT comprise 5% of GDP but drive 20% of overall productivity growth and the ICT industry makes up one quarter of total business R&D.[5] ICT are key enablers of competitiveness and innovation. By 2016, the digital economy is expected to reach €3.2 trillion in the G-20 economies. It benefits not only the 'new economy' but also traditional industries. More than three quarters of the value added created by the Internet derive from enhanced productivity in traditional industries. Companies adopting broadband-based processes improve their employees' labour productivity on average by 5% in the

1 The European Commission has adopted the DAE as part of the overall Europe 2020 strategy for smart, sustainable and inclusive growth. It proposes 101 specific policy actions across 7 domains: digital single market; interoperability and standards; trust and security; fast and ultra-fast Internet access; research and innovation; digital literacy, skills and inclusion; and ICT-enabled benefits for EU society. This combined set of actions is designed to stimulate a virtuous circle of investment in and usage of digital technologies. http://ec.europa.eu/information_society/digital-agenda/index_en.htm.

2 http://s3platform.jrc.ec.europa.eu/s3pguide.

3 http://ec.europa.eu/regional_policy/sources/docgener/presenta/broadband2011/broadband2011_en.pdf.

4 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Information_and_communication_te chnology_%28ICT%29.

5 See Digital Competitiveness Report 2010. http://ec.europa.eu/information_society/digitalagenda/ documents/edcr.pdf.

manufacturing sector and by 10% in the services sector.[6] It is estimated that just a 10% increase in broadband take-up could result in an increase in GDP growth of up to 1.5%.[7] Small and medium sized enterprises (SMEs) grow two to three times faster if they embrace the digital economy. ICT also boost job creation. In the EU, for every job destroyed by the emergence of the Internet, 2.6 new jobs have been created.[8] However, this huge potential is, as yet, far from fully exploited.

The Europe 2020 Strategy recognised the enormous potential of ICT and made the Digital Agenda for Europe one of its seven flagships.[9] Its aim is to deliver smart, sustainable and inclusive economic growth by completing the digital single market and exploiting the innovation possibilities of fast and ultra-fast Internet connections along with interoperable services and applications. The DAE has set ambitious targets for high speed Internet infrastructure across the Union and for wide deployment and more effective use of digital technologies, applications and services.

The DAE will bring widespread benefits to citizens and businesses. These include better quality of life through, for example, better health care (eHealth Action Plan), social inclusion and education (eSkills); more effective public administration (eGovernment Action Plan) and better dialogue between citizens and decision-makers (eParticipation); safer and more efficient transport (Intelligent Transport Systems), a cleaner environment and more efficient energy networks (Smart Grids, Smart Metering), inter-modal transport and sustainable cities (Smart Cities), new media opportunities and easier access to cultural contents (eBooks, online platforms for music and movies, digitisation and access to Europe's cultural heritage (Europeana). Reaching these ambitious goals and harnessing these benefits requires a culture of open data and secured online access, a true digital single market, together with an affordable high speed Internet infrastructure.

High-speed Internet connectivity is a pre-condition for the emergence and take-up of the next generation of services and technologies in areas such as cloud computing, Internet of things, research infrastructure, smart cities, smart grids, ambient assisted living, eHealth, energy monitoring, home security, high-definition audio-visual services, and others. In addition, the simultaneous use of different applications by households or businesses will require substantial bandwidth.

Ensuring access to this critical infrastructure is essential for the digital economy in order to stimulate social and economic cohesion. It creates a virtuous and reinforcing interaction between ICT supply and demand. For these reasons, the Digital Agenda for Europe set three major targets for broadband: (a) by the end of 2013: basic broadband is available to all Europeans (achieved with the aid of satellite broadband to the 4% not connected by fixed line), (b) by 2020: all Europeans have access to Internet speeds of above 30 Mbps, and (c) by 2020: 50% or more of European households subscribe to Internet connections above 100 Mbps.

Any Smart Specialisation Strategy must be inter-related with local and regional 'digital agendas', whether a region or Member State struggles to provide services in times of austerity, tries to create the conditions to foster regional innovation and growth, or endeavours to attract new investment. The long-term competitiveness of regions and their ability to achieve the fundamental objectives of regional and rural policies depend on the good planning of ICT investments. ICT is a fundamental factor both as an enabling technology and as an area of specialisation in itself.

When designing policies for digital growth, it is important to pay attention to this dual role of ICT. In all regions it is a horizontal enabler of growth in other sectors and, in many regions an important sector in itself. Broadband connectivity and e-Infrastructures lay the groundwork and basis for innovation both in ICT and in other sectors. Communication technologies create opportunities to develop services and applications to meet economic and societal needs. ICT are already transforming societies and promise even greater changes. The value of a network is proportional to the square of the number of services and infrastructures that are interconnected. The more sectors (public, private, academia, citizens and consumers) take up these new opportunities, the greater the value added with exponential rather than linear growth.

Paying attention to the dual nature of ICT facilitates the development of original responses to the challenges regions and Member States have to address. Raising awareness of the implications of ICT's dual role is also important for managing authorities and for projects.

ICT as enablers: Digital technologies are changing our lives - the way we work, shop, socialise, communicate, educate and entertain ourselves. They play a horizontal cross-cutting role in enabling innovation and the diffusion of new practises. In this respect, ICT are Key Enabling Technologies (KETs), like micro- or nano-electronics and photonics. The introduction of ICT-related processes can lead to productivity gains not only in high-tech sectors but across entire industries and value chains. ICTs can reduce barriers to entry, cut time to market, reduce transaction costs, extend global reach, sharpen market intelligence, blur industry boundaries and open doors for a new generation of entrepreneurs and innovators. ICTs speed-up and improve the way innovative products and

6 The Impact of Broadband on Growth and Productivity (2008). http://breitbandinitiative.de/wp/wp-content/uploads/2009/04/2008_micus-studie-broadbandeu_short.pdf.

7 Czernich et al.. (2010), quoted in The Socio-economic Impact of Bandwidth, Final Report. http://ec.europa.eu/digital-agenda/en/news/study-socio-economic-impact-bandwidth-smart-20100033.

8 http://ec.europa.eu/enterprise/sectors/ict/ebsn/digital_supply_chains/index_en.htm.

9 http://ec.europa.eu/information_society/digital-agenda/publications/index_en.htm.

services are conceived, developed, produced and accessed. Businesses that fail to get connected will be excluded from the global market.

But ICT are not only relevant for business purposes. Their sustainability and the engendered economic development have an impact on quality of life. User engagement and the application of technology to real life practices can help to improve urban and rural communities by connecting them through fast broadband connections. Also research and education institutes benefit from e-Infrastructures that allow fast exchange of information.

ICT as a sector: ICT as a sector represents 5% of total GDP and 20% of overall productivity growth in Europe. The digital economy is growing at seven times the rate of the rest of the economy.[10] ICT can be the basis to promote clusters and local/regional eco-systems of ICT companies in specific fields (e.g. within the contexts of future networks, Internet of things, trustworthy ICT, etc.). ICT is a natural component of product and service development and delivery in areas such as creative media sectors with culture, music, movies and games.

The main purpose of investing ESIF in ICT is to improve productivity and hence growth and jobs. The mere purchase of ICT hardware and software and broadband connectivity as such is not enough to attain this. Realising the full potential of ICT requires a combination of new digital skills, organisational and process changes, and other tools. In sum, policies for digital growth should address the dual role of ICT.

Barriers & challenges

Europe is facing an investment challenge in the financing of high-speed Internet infrastructure because private incentives to invest in faster Internet network infrastructures are not high. Experience also shows that private actors are not willing to roll-out high speed networks to all parts of Europe, thus leaving sparsely populated and lower income areas uncovered. This constitutes a serious challenge for many regions to achieve the DAE objectives and therefore the support of public funds is needed. The large amount of investment required to achieve ubiquitous coverage[11] requires a combined effort from a large number of investors from the private and public domains, the adoption of open and long-term investment models[12] and the use of a range of financial tools including grants and financial engineering.

Financing is also a barrier for many European web entrepreneurs who have limited access to venture capital, bank loans and public funding. Governments can address this e.g. by creating tax incentives,[13] setting-up public venture capital funds, leveraging private investments, or through voucher schemes. This is why synergies between different instruments are so important, an aspect discussed at greater length in Section 2.5.

One important element missing in Europe when it comes to web entrepreneurs, is awareness and facilities for Europe-wide and global marketing. These have most likely negative effects on the entrepreneurial culture and the emergence of potential new entrepreneurs, as well as the potential for source funding. In the US, there are several renowned web entrepreneurs, like Larry Page (Google) or Mark Zuckerberg (Facebook). In Europe, similar success stories exist like Niklas Zennström (Skype) and Markus Persson (Minecraft), but they are often less successful in terms of global markets and less well-known.[14]

Another crucial aspect pertains to interoperability. While adopting common standards can be disruptive for some economic activities that prosper because of the lack of common and automatic procedures, interoperability is an important goal of public action. Private incentives may limit the adoption of common procedures (advantage of market segmentation) that could generate greater benefit for all, so public authorities need to change the structure of private incentives or contribute to the creation of a larger market. The benefits of ICT are based on a network logic. Weaknesses persist in standard-setting, public procurement, coordination between public authorities and between public and private actors. Given this widespread lack of interoperable services and devices within and across EU Member States, the high potential of digital growth is not fully tapped. The use of common standards and open platforms should be considered whenever this is feasible.

The role of Structural & Investment Funds

The EU's Cohesion and Rural Development Policies, supported by other European Structural and Investment Funds (ESIF), can be used to contribute towards meeting the goals of the Digital Agenda by investing in better access, use and quality

10 Europe's Digital Competitiveness Report. http://ec.europa.eu/information_society/newsroom/cf/itemdetail. cfm?item_id=5789.

11 The European Commission estimates investment costs to be between EUR 180 and 270 billion.

12 EU Broadband Good Practices. http://www.broadband-europe.eu/Pages/Home.aspx.

13 The UK Government, for instance, announced a package of reforms to the tax-advantaged venture capital schemes. https://www.gov.uk/government/consultations/tax-advantaged-venture-capital-schemes.

14 There are examples of initiatives that seek to remedy this lack of awareness. First, the Start-up Europe Leaders Club (http://ec.europa.eu/digital-agenda/en/leaders-club) that promotes "digital champions" and raises awareness about successful European web entrepreneurs. It also shows how to improve the situation of web entrepreneurs. Some of the members are Daniel Ek (Spotify), Kaj Hed (Rovio) or Niklas Zennström (Atomico). Secondly, Tech London Advocates (TLA) (http://techlondonadvocates.org.uk) is an advocacy group that aims to support technology start-ups in finding new investment, new talent and achieving high growth.

of ICT, as stated in Thematic Objective (TO) 2 of the ESIF Regulation.[15] ICT measures can also be financed as support measures within any of the other 10 Thematic Objectives of the ESIF, particularly research and innovation, promoting the competitiveness of SMEs and the shift to a low carbon economy. There are also possibilities for supporting high speed networks in areas of market failure, as well as ensuring investment in digital service infrastructures. This can be done jointly by the ESI Funds or with or through other programmes and funding sources such as Horizon 2020,[16] Rural Development Funds,[17] ESF,[18] as well as the Connecting Europe Facility.[19] As such, Structural and Investment Funds can be used for the creation and up-grading of ICT infrastructures, to stimulate the take-up of these structures and invest in innovative services and applications.

Regional and national authorities wishing to invest in research and innovation have to adopt a RIS3. One of the key challenges for the authorities in charge of developing and implementing the strategies is to identify priorities and select adequate investment models and sources supporting their activities. Compared to other funding sources, the ESIF have the advantage that they are not entirely received through short-term project competitions, as for example in Horizon 2020. Projects can therefore be planned with greater certainty in advance. This makes them appropriate funds for developing local capabilities, something that is particularly relevant for regions which have had more difficulties to access Horizon 2020, CIP-ICT-PSP[20] and research projects more generally.

Ex-ante conditionality

For the current period of Structural and Investment Funds, one of the new ex-ante conditionalities applies. This refers to the development and implementation of national and regional digital growth measures and the promotion of the DAE goals by exploiting national and regional assets in line with the idea of smart specialisation. This conditionality applies to Member States and regions planning to allocate ERDF funding to developing ICT products and services, as well as public eServices.[21] They are obliged to specifically develop a *Strategic Policy Framework for Digital Growth.*

The second conditionality for the TO 2 applies to the regions wishing to use ERDF to extend broadband deployment.[22] These regions are obliged to develop a *Next Generation Network (NGN) Plan*.

The Strategic Policy Framework for Digital Growth should chart the obstacles and the actions needed to overcome them in order to realise the social and economic potential of ICT, most notably the Internet-related technologies. The Strategic Policy Framework must be based on evidence and set objectives that make it possible to chart them against the DAE. It must contain measures that ensure digital growth to stimulate affordable, good quality and interoperable ICT-enabled private and public services and increase uptake by citizens, vulnerable groups, businesses and public administrations including international initiatives. The Strategic Policy Framework should set out the scope, timeframe, concrete and comprehensive objectives, allocation of resources, measures to achieve these and monitoring and evaluation instruments to assess progress of implementation.

The basis for such a Strategic Framework is an **analysis of relevant socio-economic issues** (such as composition of ICT industry, ageing, education, income, level of ICT training/ skills, employment status, affordability of services, etc.) that characterise the territorial context. It should consider both demand (e.g. Internet accessibility and digital skills as conditions for the demand for ICT solutions by households, businesses and public administrations; user-centred approaches to identify the needs of private and public users; etc.) and supply issues (e.g. ICT capabilities of local firms, infrastructure, equipment, services and applications), taking into account the dual role that many of these measures play. Such a Strategic Policy Framework may contain **specific priorities** in specific ICT fields, and **horizontal priorities** supporting ICT–based innovation across all other sectors and activity areas. Priorities should stem from a **SWOT analysis** (or similar analysis) that takes into account key indicators of the DAE Scoreboard.[23]

The Policy Framework should examine potential measures and priorities that will be **coherent with relevant national and EU initiatives** foreseen in the context of the DAE, such as e-Infrastructures, broadband, cloud computing, IT security, Internet safety, open data, living labs, digital skills, digitisation of cultural heritage and products, digital aspects of active and healthy ageing, eHealth, eGovernment, smart

15 See Article 9 of the ESIF Regulation, 1303/2013.

16 http://ec.europa.eu/research/horizon2020/index_en.cfm?pg=home.

17 EAFRD support for Rural Development.

18 ESF supports better public services and business.

19 https://ec.europa.eu/digital-agenda/en/connecting-europe-facility.

20 ICT Policy Support Programme - Competitiveness and Innovation Framework Programme.

21 This applies to funding for priorities 2(a) and 2(b) of the ESIF Regulation under the thematic objective n°2; funding to developing ICT products and services, e-commerce and enhancing demand for ICT and strengthening ICT applications for e-government, e-learning, e-inclusion, e-culture and e-health. It also applies to priority 6(c) under the proposed EAFRD Regulation, enhancing accessibility to, use and quality of information and communication technologies (ICT) in rural areas.

22 Article 5 (2) (a) of the ESIF Regulation: to extend broadband deployment and the roll-out of high-speed networks and support the adoption of future and emerging technologies and networks for the digital economy.

23 In order to help Member States with their preparations for the next programming period, the Commission has developed a "Common Strategic Framework" (CSF). It is intended to help in setting clear investment priorities for the next financial planning period from 2014 until 2020 in Member States and their regions. It will allow a better combination of various funds to maximise the impact of EU investments. National and regional authorities will use this framework as the basis for drafting their 'Partnership Contracts' with the Commission, committing themselves to meeting Europe's growth and jobs targets for 2020.

cities, smart grids, intelligent transport systems, etc. Where relevant, it should have a built-in **cross-border dimension** seeking synergies and complementarities/economies of scale with other regions.

The development of the Framework should include a **wide consultation of stakeholders from public and private** domains (including academia, relevant citizen and business associations, and national regulatory authorities (NRAs) for telecommunication) and ensure coordination among different ministries and different levels of government (national and regional). It should provide specific reference to the objectives, scheduling of the actions, the budget allocated and its sources.

Managing authorities should set up **monitoring and evaluation mechanisms** and reporting and control mechanisms (including auditing, peer-reviews and mutual learning tools) to measure progress against the set targets and objectives. Preferably, these mechanisms should be integrated into the broader RIS3 monitoring provisions. Since ICT is both a sector and a set of enabling technologies across sectors, this dual nature should be addressed from the outset.

Additionally, the ex-ante conditionality on the Next Generation Network (NGN) Plan requires regions and Member States to identify the areas where public intervention is required because market actors have not rolled-out broadband infrastructures (and it is unlikely that they will do so in the near future), as well as to identify the most efficient way of intervention.

Separate Policy Frameworks or integrated RIS3?

Member States or regions planning to allocate ERDF and/or EAFRD funding to investment priorities in ICT and broadband are free to choose how they want to relate digital growth and NGN to their broader research and innovation strategies. (a) To ensure consistency, it is advisable to include digital growth policies and references to NGN plans within broader RIS3. (b) Yet, regions and Member States may also decide to develop separate Strategic Policy Frameworks for Digital Growth at national or regional level and (c) for next generation network plans. What is important is to link and align these with other relevant existing documents or sets of documents designed to reinforce the region's competitiveness, improving its social, economic and territorial cohesion while contributing to the objectives set within the DAE, the Partnership Agreements and the National Reform Programmes. However, a strategy is more than a collection of measures. In the case that measures are contained in different policy documents, they need to be embedded in a coherent approach towards the strategy's objectives. Moving from a classic ICT sector approach to a smart specialisation approach with comprehensive local/regional/national policy frameworks is a key success factor for fulfilling the ex-ante conditionality and achieving digital growth.

(a) Digital growth chapter in broader RIS3

The development of a chapter for digital growth within the Smart Specialisation Strategy[24] will help regions to identify priorities for ICT investments pertinent to their territory. Such a chapter should chart the possibilities and obstacles as well as the actions needed to realise the social and economic potential of ICT.

Within the national/regional strategies for Smart Specialisation, ICT measures could:

- feature as horizontal measures that enable other sectors such as application-driven research and user-driven innovation and, adoption of ICT including ICT-based solutions in all kinds of fields;
- have a sectoral focus targeting ICT industrial and technological leadership in R&D&I fields such as KETs, or promoting specialisations in specific market segments or niches (such as embedded and complex systems engineering, next generation computing, future Internet, e-Infrastructures, content technologies and information management, cognitive systems, advanced interfaces and smart spaces, etc.);
- include measures in support of the regional capacity to plan, manage and implement ICT measures (e.g. networking), establish accelerators and mentoring facilities for start-ups, support web entrepreneur camps, exchange good practices, organise peer reviews, monitor and benchmark, set-up innovative investment models, exploit pre-commercial procurement and other related innovative procurement activities including reinforcing cross-border and international collaboration in preparing the digital growth actions.

The identification of digital growth priorities should involve a SWOT analysis that takes the relevant DAE Scoreboard's indicators and targets into account, reflecting the main areas of action until 2020.[25] The SWOT analysis should take the DAE scoreboard as a reference grid against which performance is assessed with a view to identifying gaps requiring regional actions in the domain of ICT.

To succeed with Digital Growth Strategies, regions need to work at many levels in parallel by identifying the needs for the supply of innovative eServices (eHealth, eGovernment, etc.), the stimulation of demand for new applications (cloud computing, eBusiness) and ICT usage (eCommerce for SMEs and consumers, smart energy networks and low energy lighting, R&D, etc.). This may be integrated within all the relevant (sectoral) initiatives being developed in the RIS3.

24 It has to be noted that Smart Specialisation Strategies are not ex-ante conditionalities for the use of EAFRD resources for ICT investments in agriculture, forestry and in rural areas.

25 The DAE Scoreboard provides data and an annual assessment of the performance at EU and Member State level.

Alternatively, it may also be presented as a dedicated digital growth chapter within the RIS3.

The Northern Netherlands and the EU 2020[26] – In a position paper the Alliance of Northern Netherlands Provinces (SNN) outlines a development strategy that builds on five strong clusters in the region. ICT is seen both as a cross-cutting technology and as a sector with growth potential (eHealth, sensor technology). The concept was developed by a broad group of stakeholders covering knowledge institutions, clusters, the regional investment agency, the Chamber of Commerce, the University Medical Centre Groningen and the Social and Economic Council for the Northern Netherlands. Two of the priority areas have a strong ICT component and build on already existing assets in the region: eHealth and active and healthy ageing benefit from the Healthy Ageing Network Northern Netherlands (HANNN) that offers a highly integrated approach to healthy ageing. The region also has an internationally renowned position in the development of sensor technology (observing, recording and processing large amounts of data in a short period of time).

(b) Stand-alone Policy Frameworks

A separate Policy Framework for Digital Growth is a viable option particularly for regions and Member States with competitive ICT sectors and those with special development needs. What is important is to ensure consistency and coherence between this framework and broader RIS3 and broadband plans. It should be embedded in the analysis and priority choices of the RIS3 and be reflected in the related Programmes.

Pla idigital[27] – In 2012, the Catalan government adopted this digital strategy which covers five dimensions: internationalisation, innovation, investment, inclusion and infrastructure. 17 projects seek to drive innovation. Among these, Mobile World Capital is a prominent project that outlines a clear vision to make Catalonia a global leader in mobile telecommunications with worldwide known brand events like the Mobile World Congress. The implementation of the strategy is governed by the strategic iDigital Committee and the operational Steering Committee; both bodies are advised by an ICT Council. The Pla idigital will be complemented by the Digital Agenda for Catalonia 2020, making the digital society a transversal policy priority in Catalonia.

(c) Plan for high-speed Internet infrastructure (Next Generation Networks)

The Guide to Broadband Investment[28] presents various models for Member States and regions wishing to invest in high speed infrastructure and provides a useful toolkit for this purpose. Provided that these investments respect the relevant regulations (telecom framework, state aid guidelines, public procurement, etc.), they can benefit from a wide range of EU funding instruments, such as the Connecting Europe Facility (CEF), or ESIF.

The ERDF and EAFRD can support investment in broadband deployment in all Member States and regions. For this, each Member State and region has to assess their concrete development needs and identify the adequate types of investment to create growth and jobs. Building network infrastructures requires a mapping of existing and planned assets, an identification of the needs for reaching ambitious population coverage and take-up targets of next generation networks (over 30 Mbps) and an assessment of the most suitable investment models. This may take the form of a standalone 'Broadband Plan' (most Member States have one at national level).

The EAFRD can support the development of fast and ultra-fast broadband in rural areas including its creation, improvement and expansion, passive broadband infrastructure and provision of access to broadband and public e-government solutions. This may include small, medium and/or large scale projects. Enhancing accessibility to, use and quality of ICT in rural areas is also a focus area for the EU rural development policy under the EAFRD. This falls within the objective of promoting social inclusion, poverty reduction and economic development in rural areas. Similar to the ERDF, the use of EAFRD resources for such investments is optional and no fixed allocations per programme are foreseen.

Public money used for broadband roll-out should **leverage private investment and not replace it.** Furthermore, the value in broadband and the Internet lie in the interoperability between networks, independently of whether they are wireless or wire line. This highlights the importance of

26 http://www.snn.eu/en/europe/strategy.

27 http://www.idigital.cat.

28 http://ec.europa.eu/regional_policy/sources/docgener/presenta/broadband2011/broadband2011_en.pdf.

planning investments, coordinating activities and networks and measures to stimulate private investment. ESIF investments should be sustainable, enhance competition and provide access to open, affordable, quality infrastructure and services, which can adjust to future exigencies in versatile fashion.

While not all EU investments in broadband have to go into high-speed (30 Mbps) solutions, ERDF and EAFRD intervention in broadband networks needs to be in line with national and/or regional NGN plans.[29] Broadband state aid guidelines point out that interventions are expected to be:

- In line with a previous assessment of needs and affordability for the territory covered. This assessment must be based on an economic analysis that takes into account all existing private and public infrastructures and planned investments for at least the following 3 years (the NGN plans could provide this assessment);

- In line with priorities based on sustainable investment models that enhance competition and provide access to open, affordable, quality and future-proof infrastructure and services.

Regions are reminded to closely coordinate with national plans for high speed Internet to exploit synergies and avoid duplication of efforts.

29 A review of these guidelines is foreseen in 2014.

2. Policy Process & Digital Growth

The development of a Smart Specialisation Strategy covers the entire policy process and is described in the RIS3 Guide as a six-step process. This section follows the same structure. (1) regions and Member States conduct a SWOT or similar analysis of their current and past ICT capabilities and assets and the structure of their digital economies; (2) they involve all relevant stakeholders in the design of their Digital Growth Policy Framework and ensure that stakeholders also contribute during the implementation phase; (3) they jointly define an ambitious but realistic vision of their ICT aspirations; (4) they select a limited number of ICT priorities with high growth potential that can facilitate competing in markets in Europe and beyond; (5) they lay out an action plan and a roadmap that define measurable goals and how they are going to be achieved. This step also encompasses naming policy and financial instruments that will be used; (6) they develop a monitoring and evaluation mechanism that guarantees an effective implementation of the Policy Framework and feeds into eventual adaptations based on success or failure.

2.1 Analysing the innovation potential in ICT

The *Strategic Policy Framework for Digital Growth* should be based on a sound analysis of the country's or region's existing situation regarding the scientific and technological knowledge base and economic specialisations in ICT. There should be an analysis of its strengths, weaknesses, opportunities and threats/bottlenecks (SWOT) taking into account key indicators of the DAE Scoreboard.[30] This analysis will provide a picture of capabilities, challenges and existing regional potential. It will serve as a basis for engaging with stakeholder groups and for selecting priorities. It is likely that this process will have a number of steps and the analysis will become more elaborate throughout the process.

It is important that this analysis covers both demand and supply aspects of ICT development:

- Demand issues: include the degree of Internet accessibility and digital skills among households, businesses and public administrations which affect their potential to use ICT and demand better services and products, and identify the needs of private and public users;

- Supply issues: ICT capabilities of local firms, availability of equipment, infrastructures, services and applications, and of ICT professionals/practitioners, etc.

Moreover, relevant socio-economic issues that characterise the territorial context are important, such as the composition of the ICT industry.

When exploring opportunities within the area of ICT, analyses should examine potential measures and priorities coherent with relevant national and EU initiatives as foreseen in the context of the DAE. Key issues covered by DG CONNECT are:[31]

- ICT as enabling infrastructure (e-Infrastructures, broadband, cloud, key enabling technologies);

- ICT specialisation in services, applications and products (eHealth, digital aspects of active and healthy ageing, eGovernment, intelligent transport systems, smart cities, smart grids, open data portals, digitisation of cultural heritage, language resources, IT security, community based social applications);

- ICT up-take (ICT innovation vouchers, web start-ups, digital skills, ICT in education, living labs, music rights, pre-commercial procurement, safer internet).

If a region or Member State wants to address broadband penetration, the SWOT and socio-economic analyses mentioned above should have a dedicated section relating to the NGN Plan, examining for instance the affordability of services among the different social groups and the expected socio-economic benefits of the NGN roll-out in the different domains and territories. It should assess the needs and available resources based on an economic analysis taking into account existing private and public infrastructures and planned investments for broadband.

30 The DAE Scoreboard assesses progress with respect to the targets set out in the Digital Agenda. In addition, it provides analysis and detailed data on all the policy areas covered by the Digital Agenda. https://ec.europa.eu/digital-agenda/en/scoreboard.

31 More details on these ICT themes can be found in Sections 4-6 of this Toolbox.

When carrying out the SWOT analysis, the outward-looking dimension is vital. It should explore the activities of other regions (seeking related synergies and complementarities/ economies of scale), explore opportunities for unique niches to avoid imitation, duplication and fragmentation in identifying regional specialisations, as well as identify the role of regional actors' future activities in different value networks. The material gathered for this can come from a number of sources and methodological approaches:

- The analysis can be **qualitative**: e.g. value chain analysis, peer review, foresight, case studies, interviews, surveys, consultations, dedicated working groups, workshops and stakeholder consultations in public and private domains (including academia, relevant citizens and business associations, and the telecom NRA).[32]

- It can also be more **quantitative**: cluster analysis, patent analysis, Internet users, industrial dynamics, growing economic areas, number of start-ups, growing employment, areas of increasing cross-sectoral collaboration, DAE data etc.

2.2 Governance and stakeholder involvement

The Framework should be developed through a wide consultation of stakeholders from public and private domains (including academia, relevant citizens and business associations, and the telecom NRA) and ensure coordination among different ministries and different levels of government (national and regional).

Examples of actors to involve are:

- Private sector (telecom operators, Internet service providers, industries that are important users of ICT as a key productivity-growth booster, potential investors such as utility companies, private sector banks etc.);

- Academia (universities, research institutes);

- Public sector (regional and national authorities, European Investment Bank, public financial institutions, national telecom regulators) and managers of financial instruments;

- Non-governmental organisations (user groups from the public and private domains, policy groups such as Local Action Groups under the CLLD/LEADER, national rural networks, and consumer and citizens groups).

At a workshop on priority setting and collaboration in ICT organised by the S3 Platform and DG CONNECT in spring 2013, participants from regional administrations, companies, research institutes and universities identified governance arrangements to be of key importance for strategic innovation processes.[33] An important issue brought up at the workshop was how to delimit the group of relevant stakeholders. Often, a strong bias towards large companies and industries hinders a broader participation that includes citizen groups, SMEs and start-ups. Another related question pertained to the scope of stakeholder involvement. How encompassing or selective should such an involvement be? Can organisations that are acting as representatives participate, such as cluster organisations that represent several companies? Whether to include well-established cluster organisations rather than individual companies very much depends on the regional context. A good starting point can be to begin with the most motivated individuals and organisations and then enlarge the group incrementally (snowball method). One way to do this is to identify the entire eco-system of large and regionally relevant companies (supply chain). It is important to avoid any bias towards large corporations in this approach. Another important challenge is how to involve stakeholders, i.e. the issue of governance tools. Public consultations and focus groups are promising tools to engage stakeholders but they are only the beginning of the governance process.

Preferably, the process should generate a continuously involved stakeholder group. The group should be involved in developing the policy framework and setting priorities, and also in modifying strategies and priorities as the process evolves. It is likely that the framework will incorporate a number of groups that are part of the different areas of digital growth. Involving these stakeholders may take the form of working groups, or take place at a more strategic level. Decision-making power for these groups would be different: some might be merely consulted, whereas others will be assigned to co-decide on the selection of projects.

The actors involved should jointly embark on an entrepreneurial discovery process in which they will together identify market opportunities and economic potential for thematic areas, forming the basis for investment decisions in prioritised areas. These groups can be institutionalised to different degrees, and should coordinate across the quadruple helix,[34] as well as between different ministries and different levels of government (national and regional). It is likely that one or several leaders will take the responsibility for different parts of the Policy Framework in this process. It is important that all stakeholders recognise the appointed leaders.

Regions may also reinforce their planning and implementing capacity through technical assistance, e.g. by setting up a dedicated ICT/broadband centre of competence or an

32 NRAs are National Regulators for Electronic Communications.

33 The workshop was held in Seville on 9 April 2013. See Report of the Pilot Workshop on Priority Setting and Collaboration in Information and Communication Technologies. http://s3platform.jrc.ec.europa.eu/documents /10157/130815/Report_Pilot_WS_Priority-setting_ICT_10June2013_FINAL.pdf.

34 This refers to collaboration between government, industry, academia and citizen groups.

implementing body that takes responsibility for streamlining procurement specifications (including technical standards), state aid notifications or the collection of monitoring data.

2.3 Developing a shared vision of digital growth

Within the Strategic Policy Framework an overall vision stating overarching aims should be developed. This is a vision about what the region wants to achieve with the framework, what the main goals are and why these matter. If the Framework is a standalone document, the vision should be aligned with the goals and visions of the RIS3. The vision is important in order to engage stakeholders in the process and to keep them motivated. Through a shared vision stakeholders understand the motives for the process, which is important in formulating and implementing the Strategic Framework. In this joint endeavour, continuous and institutionalised communication is paramount. At this stage, different kinds of participatory leadership methods are recommended.[35]

Catalan vision - Having the same lead organisation, ministry or department over a longer period of time is important to bring continuity to the process and represent a joint vision. This was the case in Catalonia where the Directorate-General for the Telecommunication and Information Society was in charge of developing the Catalan vision for ICT: to become the number one mobile telecommunications region in the world and a leader in smart cities. This vision emerged from an analysis of the regional economic structure with a strong and established software development sector. Based on this potential, an ecosystem in mobile telecommunications has emerged with the help of the regional government. The main contribution from the government was to fund the establishment of the Mobile World Capital Foundation that supports businesses in this field. The major stakeholders have been and are continuously consulted during one of the largest international fairs for the mobile industry, the Mobile World Congress in Barcelona, which is also supported by the regional government.

2.4 Identifying the priorities

The Strategic Policy Framework for Digital Growth should outline a limited set of innovation and ICT-driven development priorities. The idea is that regions should identify unique areas in which they have the potential to develop competitive advantages and suitable horizontal measures. The identification of priorities is a mix of top-down and bottom-up processes. Concerning the latter, priorities are derived from existing capabilities and opportunities identified by regional stakeholders. At the same time, the process should refer to policy objectives and opportunities present in national and EU public funding schemes where appropriate.

Smart specialisation is also a question of better and more transparent spending of EU funds. Priority setting is one of the crucial issues. In the previously mentioned pilot workshop on priority setting and collaboration in ICT, participants discussed how to select the appropriate priorities and unique niches within the very broad field of ICT.[36] It emerged that almost all regions are likely to include some form of ICT components in their RIS3, even if ICT is not a priority as such. The workshop also underlined that peer interaction between regional governments, firms, clusters and universities is needed and can be very effective for the development of RIS3 and Policy Frameworks for Digital Growth, as well as for the preparation of regions and Member States for the next funding period.

Priorities are not industries or sectors *per se* but often combinations of different elements that constitute the basis for cross-innovation. The priorities will be both supply and demand driven, with the identification of needs as expressed by firms, NGOs, consumer and citizen groups, as well as public service actors and societal challenges as identified by public actors. They will also be based on supply measures, such as existing capabilities, and the ambitions in increasing broadband penetration and Internet usage, which are supply side measures. ICT can enable many other sectors such as:

- Affordable, good quality and interoperable ICT-enabled private and public services;
- International initiatives within ICT, such as enhancement of standards and inter-operability;
- Ways to reinforce ICT capacity-building and skills development where applicable.

As such, ICT as an enabler also offers solutions to societal challenges that go beyond this non-exhaustive list.

35 A good example of a participatory approach is Digital Futures, a foresight project with strong stakeholder involvement. See http://ec.europa.eu/digital-agenda/en/digital-futures-objectives-and-scope.

36 Report of the Pilot Workshop on Priority Setting and Collaboration in Information and Communication Technologies. For an overview of industries that are most affected by ICT and digital transformation, see Oxford Economics (2011), *The New Digital Economy*. http://www.pwc.com/gx/en/technology/publications/trans form-business-in-new-digital-economy.jhtml.

Smart transport and intermodality, for instance, need ICT infrastructure in order to tackle grand challenges like climate change and environmental protection. HORIZON 2020 has identified these and other challenges such as secure, clean and efficient energy.[37] Given their complex nature, they will require synergies from various instruments. Indeed, ICT-driven innovation is not only about technology, but about how technology can help to address societal challenges.

Apart from this enabling dimension, ICT is also an area of prioritised specialisations in itself. Examples of specialisations in ICT products and services are eCommerce, ICT applications for eGovernment, eLearning, eInclusion, eCulture and eHealth. These priorities should be based both on regional capabilities and needs, as well as on a potential for future success in the specialisation field (including the existence of some type of critical mass or emerging critical mass). This is also part of the entrepreneurial discovery process which identifies (potential) strengths.

In developing these opportunities, it is wise to begin with technical fields where regions and Member States already have strengths and that can be enhanced with new knowledge development. This may occur both through regional efforts and/or through connections to external actors. It can be fruitful to collaborate with other regions when developing ICT priorities. Regions and Member States should know who is doing what concerning ICT in Europe and beyond in order to explore the potential for collaboration. Similarly, regions and firms should be aware of their position in European and globalised markets to ensure their success in very competitive markets.[38] Finally, in exploring and identifying these fields, regions and Member States should examine the Framework's coherence with relevant national and EU initiatives foreseen in the context of the Digital Agenda for Europe (e.g. Cohesion policy, Horizon 2020, Connecting Europe Facility etc.).

2.5 Defining an action plan/ roadmap with a coherent policy mix

The Strategic Policy Framework for Digital Growth should develop an intervention logic and a roadmap stating the objectives as well as action lines and policy mixes to reach them. Useful guidance on strategic ICT areas and measures can be found in Sections 4-6. The roadmap should include a division of responsibilities between private, public actors (at different levels and with different areas of responsibility), academia and NGOs for the implementation of these action lines. Measures should take into account interoperability, as regions and Member States do not yet reap maximum benefit from this. The different ICT applications should be interoperable and based on standards and open platforms.[39]

The Policy Framework should stimulate private R&D&I investments, for instance through public-private partnerships. Another model is to create public-private-people partnerships that involve the experience of end users in projects. For broadband it is important to identify the most appropriate model of investment. The Strategic Policy Framework should coordinate public and private activities, also between departments/ministries/agencies. Regions should also identify measures to reduce cost and facilitate private investment e.g. by exploiting synergies in civil engineering and co-investment of utilities in other infrastructures such as transport, energy and water networks. This would facilitate co-deployment and sharing of existing infrastructure. Strong emphasis should be put on the relationship between research/science and economic policies, but also with regard to other relevant areas such as education, employment and rural development policies, as well as important DAE areas like health, security and transportation. It should coordinate between regional and national activities, i.e. be in line with the National Reform Programme and existing innovation or digital programmes. The policy mix and lines of activities to achieve the objectives can and should include a sufficiently balanced mix of soft innovation support services and financial instruments as well as having a balance of supply and demand side activities. The policy instruments should foster the internationalisation of SMEs and external linkages of regional clusters and initiatives.

Regions and Member States should take into account potential conflicts with existing state aid rules. Notably, public administrations planning to use public funds to deploy broadband projects need to anticipate whether such a project may constitute state aid: it is important to clarify if it requires prior notification and, if this is the case, to consider the main principles that the European Commission will apply to assess it. Aid must be complementary and must not substitute or distort investments of market players. State aid for broadband should, therefore, not be used in areas where market operators plan to invest or have already invested. Regions and Member States can choose the potential business models for their broadband project and the most suitable technology for their requirements since state aid rules are technology neutral. Yet, the project must ensure a 'step change' in terms of broadband availability and comply with a number of compatibility conditions within the EU's internal market. It is also important to consider other types of support, e.g. lowering civil engineering costs or supporting demand through the use of vouchers. In case of doubt, it is advisable to contact relevant institutions and information

37 It is foreseen that for developed and transition regions 20% of ERDF funding is allocated to energy efficiency and renewable energy, and 6% for less developed regions.

38 The S3 Platform has compiled a database (Eye@RIS3) covering around 70 regions and their RIS3 priorities, including digital growth priorities. It can be accessed at http://s3platform.jrc.ec.europa.eu/map.

39 European Commission, A Digital Agenda for Europe, COM(2010)245 final. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF.

sources in your country (e.g. National Regulatory Agencies, relevant ministries, broadband competence centres, and managing authorities for ESIF) and their websites. The Broadband Investment Guide[40] and the Guidelines on Regional State Aid outline what authorities should consider.[41]

The Framework should provide specific reference to the objectives, scheduling of the actions, the budget allocated and its sources (i.e. regional, national, private and EU: especially CEF, ERDF, and EARDF). It should also describe synergies between different European, national and regional funding sources, in particular between ERDF and Horizon 2020.[42]

Cooperation within existing and new networks of different organisations can be an appropriate policy instrument in many regions and Member States.[43] Networks both inside regions and between different regions involving the four categories of stakeholders of users/citizens/consumers, industry, academia and the public sector have several potential benefits. They can facilitate interaction between actors across and within borders, improve the understanding the needs in other regions and find relevant partners to work with, and to identify relevant partners in different areas and sectors. These networks could carry out joint projects, apply for research projects, and collaborate on public procurement or bid for procurement projects.[44] They facilitate the search for partners and enhance knowledge dissemination and sharing of good practises. Finally, these networks can be seen as one part of an infrastructure supporting innovation. These types of networks could be used for the pre-validation of ideas for different market niches in Europe, but also for testing at later stages. Tools like living labs could also be used in this context, where participants can conduct an EU-wide test and build development networks.

Living Lab on Wellbeing Services and Technology (Western Finland)[45] – Perhaps the most outstanding example of an ERDF-funded living lab initiative is this finalist in the RegioStars 2013 competition. It is an innovation platform enabling a new way of producing services for elderly people in a functional Public-Private-People Partnership (PPPP). Users actively participate in product development, service design and usability testing processes. The testing of welfare services and technologies took place in real life contexts, in elderly people's homes and service homes.

Another interesting area is open data. To increase opportunities for innovation, access to inter-European data that is comparable, interoperable and openly accessible would be greatly beneficial.

Open Data Gencat[46] - The portal of the government of Catalonia publishes public sector information aiming to foster its use and reuse of information. Accessible information comes from different public organisations of the Catalan government and is grouped into an easily searchable data catalogue. Data are available in different formats, most of which are standard, so they may be reused easily. The portal currently provides more than 1,400 datasets from 15 regional public authorities and departments (e.g. maps, tourist information, socio-economic indicators, employment offers and cultural events).

When developing the Strategic Policy Framework, an accompanying theory of change or programme logic should be developed, setting out the visions and goals of the strategy and connecting the activities and measures to these goals. In short, it should present the logical connections between the planned activities and make them more comprehensible.

2.6 Monitoring & evaluation

Current and past funding programmes have often focused excessively on absorbing available funds. In many cases, objectives were vaguely defined, it was difficult to recognise success or failure, and evaluations were mainly focused on bottlenecks in implementation rather than on impact, making it difficult to demonstrate policy results. The new funding period took into account this lesson and it now focuses on results. This translates into the necessity for specific objectives (what do you want to change), valid indicators to capture this change, identification of baselines (the situation before the programme), and a demonstration of how the outputs of the programme will contribute to change. Results relate to broader change in the region or enabled sector or the ICT sector itself – not just for the directly supported organisations.

40 http://ec.europa.eu/regional_policy/sources/docgener/presenta/broadband2011/broadband2011_en.pdf.

41 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:209:0001:0045:EN:PDF.

42 Other interesting sources are: ESF, EAFRD, COSME, JEREMIE, Connecting Europe Facility, ENIAC for nano-electronics, the ARTEMIS Joint Technology Initiative on embedded computing systems, Factories of the Future, Green Cars initiatives, EIT Knowledge and Innovation Communities and Labs, knowledge regions, Eurocloud, Competitiveness and Innovation Framework Programme (CIP) ICT Policy Support Programme, Grand Coalition for Digital Jobs, GÉANT, Research Data Alliance, European Innovation Partnerships, Global Repertoire Database, Safer Internet Programme, and the European Network of Living Labs.

43 Report of the Pilot Workshop on Priority Setting and Collaboration in Information and Communication Technologies.

44 Joint projects should 1) be strategically relevant to RIS3, 2) involve partnerships with other regions and quadruple helix actors, 3) include measures to be implemented which can be evaluated based on their results, and 4) be financed preferably by the private sector, or through cost sharing between private and public to create incentives for growth-enhancing investments.

45 http://www.prizz.fi/wellbeinglivinglab#.Utj6I3cmZ8E.

46 http://www20.gencat.cat/portal/site/dadesobertes?newLang=en_GB.

Against this background, regions and Member States should set-up monitoring and evaluation mechanisms that can make the *Strategic Policy Framework for Digital Growth* both stable and responsive. In this way they can react to changing circumstances with new challenges and opportunities. The cancellation of activities should be considered if these have proven futile. The monitoring and evaluation system should identify concrete, achievable goals and have output and result indicators with realistic timelines for these goals. At the same time, the mechanism should measure the progress in the relevant areas which are aligned with existing relevant sectoral EU, national or regional DAE-relevant priorities,[47] such as measurements of the progress of ICT use and its impact (e.g. productivity gains) at national or regional level. The use of indicators compatible to the DAE Scoreboard is recommended. At the same time additional country or region specific indicators are often needed to track the progress of the implementation measures. Due to the dual nature of ICT (enabling technology and sector in itself), developing these systems can be challenging as it is difficult to capture dynamic effects and impacts of ICT on other areas.

Regions and Member States should develop an appropriate governance mechanism that can act and react using the data from the monitoring and evaluation system. This mechanism will support a process of continuous policy learning and adaptation. The responsible managing body should be as independent as possible in its work and should set up monitoring and evaluation mechanisms as well as reporting and control mechanisms (including auditing, peer reviews and mutual learning tools) to measure progress against set targets and objectives. Ideally, this should be an integral part of the RIS3 monitoring mechanisms.

47 If the DAE policy framework is part of a national or regional RIS3, its monitoring should be carried out as part of the monitoring of this framework.

3. Support Provided by Commission Services & the S3 Platform

The S3 Platform, together with other relevant Commission services, provides specific assistance to regions and Member States with respect to the development of a Digital Growth Policy Framework. Such support can specifically take the form of:

Peer reviews[48] - One of the main activities and tools offered by the S3 Platform is peer review. Peer review workshops bring together regions and Member States for mutual learning and exploration of ways in which innovation strategies can be developed. The S3 Platform aims to create an open and trusted learning environment where practical and conceptual aspects of RIS3 and digital growth can be discussed and explored through the challenges and experiences of individual regions. The workshops allow regions to meet their peers, European Commission staff, academic experts and others to discuss common issues related to smart specialisation.

Thematic workshops[49] - The S3 Platform has a modular concept around thematic workshops, which can be used for specific workshops on different themes, but also modified for sessions within other conferences. Regions, Member States and associations interested in arranging thematic workshops under the S3 label can contact the S3 Platform at jrc-ipts-s3platform@ec.europa.eu. The support for thematic events provided by the Platform includes templates on how to design these sessions, how to address different issues, and whom to involve. In addition, the S3 Platform can provide support with expert involvement and send team members as speakers. Finally, the events can be communicated through the S3 Platform communication channels (communication directly to registered regions and through the website).

Eye@RIS3[50] - RIS3 is a process, at the end of which regional/national strategies should identify activities in which an investment of resources is likely to stimulate knowledge-driven growth. Eye@RIS3 is an online database to help with this strategy development. Regions are requested to introduce/update input in the database, which produces a realistic map of the RIS3 priorities in Europe. The database provides users with information on the envisioned priorities of regions and Member States. The purpose of the database is to give an overview of regional and national priorities in order to enable others to position themselves, to find their unique niches and to seek out potential partners for collaboration.

Living Toolbox[51] – On the Toolbox website, additional information, further readings and relevant event announcements will be posted. The website is a living document that will be kept up to date and up-graded together with ICT developments and related information on Structural and Investment Funds and smart specialisation.

Informal assessment – The S3 Platform, DG CONNECT and DG REGIO can provide an informal assessment of draft Policy Frameworks for Digital Growth if regions and Member States want prior feedback on this and related documents. More information can be found in APPENDIX 1.

Technical assistance and experts – Upon request from regional or national authorities, the European Commission can hire an expert to assist them with the design and implementation of ICT-related development strategies, with particular focus on the regional level.

48 http://s3platform.jrc.ec.europa.eu/peer-review.

49 http://s3platform.jrc.ec.europa.eu/thematic-workshops.

50 http://s3platform.jrc.ec.europa.eu/map.

51 http://s3platform.jrc.ec.europa.eu/digital-agenda.

4. ICT as Enabling Infrastructure

4.1 Broadband infrastructure – Next Generation Networks

Why invest in Next Generation Networks?

It is estimated that just a 10% increase in broadband take-up could result in a 0.9-1.5% increase in GDP growth.[52] Universally available, fast and reliable telecom network infrastructures are and will increasingly be a precondition to efficient communication in business and social environments; it is also underpinning innovation and further increases in the overall productivity of the economy.

By 2020, Europe will see the emergence of a new generation of services and technologies in areas such as cloud computing, Internet of things (machine-to-machine communication), smart cities, smart grids, e-Health applications, e-Government, high-definition and interactive audio-visual services, etc. All these services will require high-speed connectivity, for the processing power of "big data" and storage capacity will increasingly be "in the net". In addition, the simultaneous use by households or business of different terminals (PC, tablets, smartphones, connected TV, smart boxes, sensors, etc.) and multi-media, interactive and high-definition applications will substantially increase demand for bandwidth above 30 Mbps.

Ensuring access to this critical infrastructure – the so-called Next Generation Networks (NGN) - is therefore essential not just for the development of a digital economy but also for stimulating social and economic cohesion, i.e. ensuring that there will not be a "digital divide", but rather harnessing ICT capacity to bring down barriers between urban and rural areas, central and periphery, or between social groups or generations. For these reasons, the Digital Agenda for Europe foresees that:

(i) by the end of 2013, basic broadband should be available to all Europeans,

(ii) by 2020, all Europeans should have access to much higher Internet speeds of above 30 Mbps,

(iii) by 2020, at least 50% of European households should subscribe to Internet connections above 100 Mbps.

While it is expected that most of the investments necessary for the NGN will be made by telecom operators, European Structural and Investment Funds and other national public funding can also support and accelerate this deployment in all Member States and Regions, notably in areas of market failure.

52 Czernich et al. (2010), quoted in The Socio-economic Impact of Bandwidth, Final Report. http://ec.europa.eu/digital-agenda/en/news/study-socio-economic-impact-bandwidth-smart-20100033.

RAIN project[53] (Lithuania): The objective of the project is to improve access to broadband with ERDF in rural areas and achieve 98% broadband coverage in Lithuania by 2014. Some 4,400 km of broadband cables have been laid, with network infrastructure and 775 sub-district and municipal connection points installed. As a result, 660,000 citizens (20.6% of the country's population), 2,000 businesses and 9,000 public institutions can now benefit from broadband. The creation of backhaul networks (i.e. middle-mile) in not-served areas has reduced the entry barriers (by lowering investment costs) for commercial operators thereby encouraging them to extend their broadband network coverage in last mile in rural areas. The rain project is providing connectivity to many public institutions (e.g. 524 public libraries), contributing to increased digital literacy among rural communities and sectors of the population at risk of exclusion, by making Internet access centres publicly available and supporting rural businesses (e.g. declaration of agricultural lands and crops).

Sweden's **Rural Development Programme**[54] (2007-2013): The Swedish RDP has foreseen EAFRD support for broadband infrastructure. The initial EAFRD allocation was increased almost 5-fold to reach EUR 136.4 million due to high demand for NGN connectivity from rural areas. Despite Sweden's sparse rural population (two people per km^2 in some areas), the supported broadband scheme has provided basic and NGA coverage to approximately 25,000 premises, out of which 80% are citizens and 20% are companies. A major part of the investments came from non-paid voluntary work (e.g. through village associations) and was eased by access to existing infrastructure such as fibre ducts or copper lines. The scheme contributed to the Swedish EU-leading position of having 53% of all households and businesses connected with at least 100 Mbps Internet and 93% of all Swedish households and businesses having access to mobile broadband via 4G networks (LTE) with 79% in rural areas to be compared with just 10% before the project.

How to act?

1. Analysis: The planning of a broadband project financed under an ERDF operational programme or EAFRD rural development programme needs to be embedded in a comprehensive plan for investment in NGN infrastructure set at national or regional level (2nd ICT ex-ante conditionality). The NGN Plan should be based on the main indicators of *NGN coverage* and *take-up* used in the Digital Agenda scoreboard.[55] It may also address other dimensions such as quality of service, reliability/resilience, open access, etc. The NGN Plan or the "Digital Growth" document (1st ICT ex-ante conditionality) may also look into issues related to supply and demand, such as affordability of services, as well as related socio-economic factors explaining penetration rates in business and households (e.g. education, ICT training, ageing, employment level, etc.).

A critical tool for the planning of broadband infrastructure measures is the mapping of existing broadband infrastructures and of forthcoming private investments (typically in the next three years, in line with State aid guidelines)[56] enabling regional and local authorities to identify the areas of interventions where there is a market failure.

2. Governance/stakeholder involvement: Stakeholders engagement at an early stage would typically include:

- National, regional and local authorities responsible for planning, implementation or monitoring of broadband projects, as well as other public stakeholders such as the Telecom National Regulatory Authority (NRA), relevant agencies/authorities (development & innovation, competition, broadcast, etc.), entities in charge of mapping broadband and other infrastructures, etc.
- User communities and other groups of potential final beneficiaries: business, schools/universities, hospitals, local administrations, rural development communities, etc.
- Potential broadband network and services providers in the region: telecom operators and ISP, utility companies, ICT industry, content providers, etc.

The involvement of the national regulatory authority for electronic communication (NRA) in all stages of the programming and particularly at monitoring stage would help the project development and the respect of relevant regulation including the compliance of certain aspects of competition (state aids), setting wholesale access price, open access regulation, interconnection standards, etc.

3. Priority setting: In setting priorities for investment, planning authorities should:

- Identify the objectives of the broadband projects. In order to allow benchmarking with the objectives of the NGN Plan and the Digital Agenda targets set by 2020 (see Section 1), these should be expressed in terms of household coverage/access and/or take-up/penetration based on download speeds. Other dimensions worth considering are upload speeds, reliability and affordability. However, the definition of the objective(s) in terms of specific technologies (e.g.

53 http://ec.europa.eu/regional_policy/projects/stories/details_new.cfm?pay=LT&the=45&sto=2265&lan=7&reg ion=ALL&obj=ALL&per=2&defL=DE.

54 http://www.pts.se/en-GB/News/Press-releases/2012/Broadband-support-provides-a-boost-for-fibre-deploy ment-in-rural-areas/.

55 https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/DAE%20SCOREBOARD%202013%20-%202-BROADBAND%20MARKETS%20.pdf.

56 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF.

fibre, cable, wireless LTE or satellite) is not recommended in order to respect the principle of technology neutrality.

- Consider the financial cost/benefits and socio-economic impact of phased and/or territory targeted interventions (e.g. giving priority to schools, universities, hospitals, business parks, white areas, etc.) *versus* more integrated interventions. An articulation between ERDF and EAFRD and other ESI funding interventions should also be examined.

- Select the best-suited investment model – principally considering models based on financial instruments (e.g. through the Connecting Europe Facility) – for the objective to be reached. For further information, see the Guide to Broadband Investments).[57]

- Concerning the financing of broadband satellite services there is a guide about a Voucher Scheme to access satellite broadband services in remote areas to close the last white gaps of basic broadband.[58] It is based on successfully completed pilot projects in France, England and Scotland in areas of market failure with public support.

4. Policy mix: The use of public funds should not crowd out private investment as this is a sector that is normally driven by market players. This therefore requires the respect of the EU State aid guidelines on broadband[59] and other competition rules set by the national NRA.

Public authorities should also strive to reduce civil engineering-related costs of investment by putting in place transparency and coordination measures between telecom operators and utility companies (water, energy, transport, etc.) - see the Commission proposal[60] to that effect. This may notably facilitate co-investment or co-deployment of infrastructure from the relevant interested parties.

5. Monitoring and evaluation: Relevant broadband indicators to monitor the achievement of these targets should be aligned with the ESIF Regulation's output indicator (see p. 21) and categories of expenditure, as well as with the main Digital Agenda scoreboard indicators and thus enable comparison at national and EU level. Ideally, they should also be complemented with further broadband indicators, if any, commonly collected by the NRA for its own purposes.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/broadband-infrastructure

57 http://ec.europa.eu/regional_policy/sources/docgener/presenta/broadband2011/broadband2011_en.pdf.

58 http://www.broadbandforall.eu/Resources/Eligibility-and-Vouchers.pdf.

59 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF.

60 http://ec.europa.eu/digital-agenda/en/news/proposal-regulation-european-parliament-and-council-measures-reduce-cost-deploying-high-speed.

4.2 H2020 R&D/ e-Infrastructure for R&D

Why invest in e-Infrastructure for R&D?

E-Infrastructure refers to ICT infrastructures for research and innovation covering networks, data centres, computing, e-government services and the broader public sector. It has strong spill-over effects for the overall economy as it is both a stand-alone sector and an enabling infrastructure for other sectors. Investments in e-Infrastructures support growth within and through the ICT sector, and create possibilities for fostering innovation in other sectors. ICT tools and infrastructures ("e-Infrastructures") have transformed research, development and innovation (RDI):

- Research increasingly takes place through collaboration in large research teams that span several organisations and countries. This means that researchers need high speed telecom connections to collaborate online.
- RDI relies on computers and software for modelling, simulation and analysis. Almost no RDI is possible today – from the design of a car part to the prediction of weather – without access to proper computing resources.
- "Big data" is the new fuel of research and innovation. This means that data must be preserved and made discoverable, accessible and re-usable. This requires deploying a data infrastructure within organisations as well as at national or regional level.
- ICT expertise is in short supply but is necessary to support the above three requirements. Supplying the appropriate skills is an integral part of the e-Infrastructure.

Access to state-of-the-art e-Infrastructure is necessary for all players of the RDI ecosystem: Universities, research centres and laboratories where academic researchers work; companies designing products and services; national or regional computing and data centres and research libraries supplying services to researchers and innovators; and public authorities and research agencies that need to monitor RDI investments.

Today *no country or region can be competitive in RDI without an advanced e-Infrastructure*: high-capacity and high-performance communication networks, computing services, scientific application software, data repositories, computational expertise and a system that encourages collaboration and sharing of information. E-Infrastructures are also often used beyond research, for example in education or public services, e.g. to provide hospitals and public libraries with ICT tools and high-speed connections.

Therefore, regions wishing to invest in RDI should consider the strategic role e-Infrastructures play for advancing towards the EU 2020 objectives of smart, sustainable and inclusive growth. By investing in e-Infrastructures, regions empower their researchers and innovators to remain or become important RDI players. Where in the past motorways were a crucial infrastructural requisite for a region to become competitive, the deployment of e-Infrastructures today connects a region to the European and global "knowledge highways", enabling scientific excellence and innovation for its scientists, engineers and companies. In this context, the EU's Structural and Investment Funds should not only be used to set-up new infrastructures, but also to upgrade and maintain existing ones.

The new cutting-edge **WIGNER Data Centre in Budapest**, funded by the Hungarian government through the Research and Technology Investment Fund, is an extension of the CERN Tier-0 data centre in Geneva. As one of the first beneficiaries of the EU-funded GÉANT ultra-fast multiple 100Gbps network, the WIGNER e-Infrastructure facility of 500 servers, 20.000 computing cores and 5.5 Petabytes of storage provides the necessary resources for the storage, distribution and analysis of around 30 Petabytes of data generated by the **Large Hardon Collider**[61] in CERN. The capacity of the centre will gradually ramp-up following the needs of the LHC. The additional benefits of the Data Centre will help the Wigner Research Centre to become a focal point of advanced technology and know-how and a highly influential player in the area of international knowledge sharing and distribution.

Barriers & challenges

ICT infrastructures play a strategic role as a crucial asset underpinning European research and innovation policies.[62] However, European regions vary considerably in their e-Infrastructure development and use. Their capacity to turn knowledge and skills into sustainable competitive advantage may therefore be limited by sub-optimal e-Infrastructure.[63] Typical bottlenecks are: (a) missing or not well-developed national/regional multi-annual plans (roadmaps) for budgeting and the prioritisation of investments in research infrastructures, including e-Infrastructures; (b) lack of appropriate national financial instruments for the development, operation and upgrade of e-Infrastructures; (c) lack of awareness of the national managing authorities of the strategic role of e-Infrastructures and their contribution to sustainable regional development, economic growth and

61 http://wlcg.web.cern.ch.

62 Communication COM(2009) 108 final, ICT Infrastructures for e-Science.

63 In the programming for ESIF, ICT-based research infrastructures have been supported with the aim to bridge the digital divide especially between new and old Member States. Measures included e.g. the deployment of fibre optic cables for public usage in libraries, hospitals, schools and universities.

attraction of scientists and engineers;[64] (d) weak involvement of regional representatives in cohesion policy actions (in particular in the identification of priorities regarding regional e-Infrastructures); and (e) insufficient knowledge exchange and engagement between research communities and regional institutions and authorities. E-Infrastructure investment may be necessary to support the RDI priorities identified in a RIS3, or the priorities of a digital growth chapter within the RIS3.

How to act?

1. Analysis: Regions wishing to invest in e-Infrastructures as part of a RIS3 may want to consider the following actions:

a. Analyse the country/region's e-Infrastructure development by including all its core components (i.e. Research and Education Network Networking infrastructure, computing infrastructure (grids/clouds/supercomputers), data infrastructures, potential users, skills and investments) at local/campus, regional and/or national level. As baseline for the analysis the set of benchmarking indicators proposed by the European e-Infrastructure Observatory could be used or any other set of meaningful, measurable, and quick and easy to produce indicators, which allow to capture the key aspects of e-Infrastructure like capacity, costs and utilisation;

b. Work with local partners to identify and assess challenges and needs for the development of new or upgrades of existing e-Infrastructures to be addressed by the region/country, including prioritisation and possible means of intervention;

c. Determine the availability of skills and the national/regional needs for development of human capital in areas where new skills and professions will be needed, e.g. data-intensive research, computational sciences or e-Infrastructure operations.

d. Estimate the costs and investigate potential sources of funding, including through PPPs;

Through the collection and utilisation of appropriate indicators, the **European e-Infrastructures Observatory**[65] can be used to monitor Infrastructure development through an interactive and user-friendly interface.

2. Governance/stakeholder involvement: Public regional and local authorities should engage with relevant stakeholders. These actors will vary depending on the available potential in a region, but may include:

- Public sector, such as national/regional ministries in charge of education, research, ICT, competitiveness, SMEs etc.; regional development organisations; and local government.
- Research organisations, universities, libraries, museums, documentation centres and research archives.
- National/regional research and education network operators, computing and data centres, and Internet providers.
- Industry active in technology development and innovation, including SMEs.

3. Priority setting: Stakeholders should jointly agree on priorities in this area. When deciding what e-Infrastructure investments they will need to support within their RIS3 priorities, Member States and regions should consider the following objectives:

a. Availability of rich computational infrastructures and services (HPC, clouds, grids, simulation software and tools) which are adapted to regional needs and future aspirations. Computing facilities may either be physically located in the region (e.g. if the region or Member State wants to specialise in IT or become a computation hub) or be made accessible remotely;

b. Data access, storage, discovery, integration, curation and analytics; this may be driven by thematic needs, e.g. if the region aspires to be an innovation hub for marine biology then it needs to ensure a role on the international stage in managing the corresponding data;

c. Development and operation of the research and education network at campus, local and regional levels, and its connection to the pan-European network GÉANT;

d. Interoperability of the above infrastructures at European and global level;

e. Availability of an authentication and authorisation system for access to services that is interoperable at EU level and facilitates mobility of researchers;

f. Availability of the corresponding skills in academia and industry.

64 The dynamic technological development and the need for increasingly advanced services for instance for e-Science, e-Infrastructures require continuous replacement and update. Funding should be targeted at the deployment of new e-Infrastructures (supercomputers, cloud infrastructure, high-speed connectivity, data repositories, etc.) and updating existing ones. The setting-up of a national roadmap for research infrastructures is recommended, such as the Strategic Vision for UK e-Infrastructures from 2011.

65 http://www.enventory.eu/indicators-on-maps.html.

NREN - Hungarian National Research and Education Network[66] - In the last decade, the Hungarian NREN has made a giant leap forward thanks to the financial support of the EU. The recent development is an important move forwards for the mutual benefit of both Hungary and Europe at large. The National Information Infrastructure Development Institute (NIIFI) develops and operates the Hungarian NREN and as such it has been part of the EU-funded high-speed research network GÉANT since 2000. The EU has been supporting GÉANT through its Research Framework Programme with EUR 93 million for the period 2009-2013. Part of this funding ensures the connectivity to GÉANT, which is linked to 10 regional networks across the world, reaching some 86 million users worldwide. It drives regional co-operation across the EU and strengthens European research as a whole. Until recently the optical segments of the infrastructure were dominantly based on leased lambdas. Since 2011, the new optical backbone, HBONE+, is working on some 3,000 km fibre network. For the renewal of the Hungarian NREN backbone and two other e-Infrastructure projects, NIIFI is receiving ca. EUR 18 million funding from the Structural and Investment Funds, through the Second National Development Plan. The budget of NIIFI for academic and research networking within the Hungarnet community in 2010 has been EUR 6 million.

4. Policy mix: With respect to RDI funding in general, precondition for success is the synergy of regional/local funding with other sources of funding both at the national and at the EU level. Besides improving efficiency in the use of available resources, this is important to ensure infrastructures which scale from regional to EU level. Note that strengthening European research infrastructures, including e-Infrastructures, is one of the specific objectives of the "Excellent Science" part of Horizon 2020 which fosters excellence of European research and innovation. Practical information about funding opportunities will be contained in the Work Programme of Horizon 2020. Unlike the current period, a single e-Infrastructure project (initiative) may receive support from ESIF and Horizon 2020. In addition, Inter-regional networks such as TERENA are useful for sharing knowledge and promoting the development of ICT infrastructures and services for research and education communities.

The Czech multi-regional Operational Programme "Research and Development for Innovation"[67] has allocated almost 70% of the total funding (EUR 2 billion) to European Centres of Excellence and Regional R&D centres and new RI. A new national Centre of Excellence in IT (IT4Innovations)[68] has been built in Brno (South-East region) and in Ostrava (Moravia-Silesia region) with a Structural Fund contribution of EUR 66 million. Part of the project is the acquisition of a high-performance supercomputer that is planned to be put into operation in 2014, when it is supposed to rank among the top 100 most powerful supercomputers in the world. The centre will employ about 200 highly qualified researchers. Specialists from other parts of the Czech Republic and the whole world will be recruited throughout the entire period of the centre's start-up.

5. Monitoring and evaluation: A RIS3 needs to include a monitoring and review system with quantifiable targets. Therefore, e-Infrastructure investments therein need to also have clear metrics, e.g. in terms of the capacity of the communication network, the number of users, the capacity of computing systems, the volume of research data that are made available, the number of user authentications per month, research data traffic within and in/out of the country (normalised by GDP), the installed computing capacity, the bandwidth-length (Gps-km) of the research network, the number of institutes/universities that have clear data policies and others.

Further reading

http://s3platform.jrc.ec.europa.eu/einfrastructures-for-innovation

66 http://www.hungarnet.hu.

67 http://ec.europa.eu/regional_policy/country/prordn/details_new.cfm?gv_PAY=CZ&gv_reg=ALL&gv_PGM=1245&LAN=7&gv_per=2&gv_defL=7.

68 http://www.it4i.cz/en/what-is.php.

4.3 Cloud computing

Why invest in cloud computing?

The defining feature of cloud computing (CC) is that cloud users, including public administrations, SMEs and non-profit organisations, do not need to invest substantial amounts of money in IT infrastructure, but pay for actual usage, according to current demand. This translates into a major reduction of costs for public administration, easier access to state-of-the-art technologies and flexibility for increasing IT capacity on a need basis. This is a major advantage given the steep rise in demand for computing power. It can be difficult to absorb substantial expenditures on in-house ICT infrastructure to offset growth.

CC and take-up of services contribute to a more cost-efficient public administration through e-government. Cost savings are based on standardisation and system integration. However, the benefits are not limited only to the public administration. A broad adoption of cloud services increases the participation of SMEs in public procurement, especially in markets which have been previously highly concentrated. Thus, companies gain easier access to new markets and sectors. This drives competition, creates innovation and reduces the costs of IT procurement.

In terms of macroeconomic benefits, CC offers a strong productivity boost for companies and the European economy. It is a core driver for innovation and can enhance industrial strength (high-end computing, gaming, engineering etc.). Work can be done more quickly, more efficiently and in a cost-effective manner. CC advances the revolution that ICT has started, users can access their content, and use their software when and where they need it, e.g. on desktop computers, laptops, tablets and smartphones, as long as there is a sufficiently robust broadband Internet available. Moreover, it can help organisations to reach out to their communities.

Barriers & challenges

Possible barriers exist both in terms of hardware and software. Only a few large data centres for CC are likely to be truly successful given their economies of scale. Another barrier pertains to the choice of leasing or buying hardware. Leasing costs are much more difficult to estimate. Finally, when it comes to software it is important to choose cautiously between expensive tailor-made solutions or standardised cost-efficient solutions that can be up-graded gradually and have low starting costs. This latter option is often the best choice for e-government solutions at local and regional level.

CC entails both local and global challenges. Local providers may be disadvantaged compared to other large service providers from abroad. This reflects the highly competitive global market for CC and the possibility of easily outsourcing to other countries and regions worldwide.

How to act?

1. Analysis: Regional and national authorities should first survey which opportunities and capabilities they have.

- Broadband constitutes the physical backbone for cloud computing.
- Data centre provision would be appropriate in a limited number of regions with a good broadband backbone and specific local attributes (e.g. water or renewable energy resources for cooling servers, or specific ancillary skills for running software as Software as a Service). The large data centre in Hamina, Finland, is a recent example of this.
- Large data centres have several advantages: better quality, newer equipment and high utilisation rates (70-80% compared to 20% in more fragmented data centres).
- Other regions should identify the closest data centres and analyse the resulting opportunities.

Regions can also ask for guidance from their national government on (a) the usage of cloud computing and services, (b) the development of migration plans to the cloud, and (c) risk assessment (legal compliance, business risk, identify small pilot projects that can be scaled-up).[69]

2. Governance/stakeholder involvement: In this process, involving key stakeholders and creating appropriate governance mechanisms is very important. Relevant stakeholders are SMEs, large firms (especially chief information and financial officers), finance and administration departments in the public sector, IT procurers, local authorities, software companies and systems integrators. Relevant networks are Euro-CIO, CIO-NET, and Eurocloud which is mainly business-driven.[70]

3. Priority setting: These actors, together with the ones in charge of the strategic framework, should identify what kind of application priorities to focus on. Common applications are e-mail, customer management/websites, Internet platforms and burst stability (backup in cases of outage or other emergencies).

4. Policy mix: The next step is to develop a roadmap, with accompanying activities and policies to drive cloud adoption among public administrations and to align with private actors, national, regional and EU policy programmes and activities. Such activities would include all the activities that are designed to drive cloud use, such as common technical requirements, drafting cloud strategies at local level, creating

69 ENISA has co-developed practical recommendations on risk assessment. http://www.enisa.europa.eu/activities/risk-management/files/deliverables/cloud-computing-risk-assessment.

70 Slovenia has been very interested in the use of regional development funds. In 2012, Slovenia received the Eurocloud award for best cloud services. http://www.eurocloud.org/press-release-slovenian-award-winners.

common provisioning platforms, or building platforms for the exchange of best practices at national level. It should be associated with H2020 priorities in relation to cloud, e.g. software, advanced computing, e-government, security and trust, environment and smart cities.

Given the highly competitive market, it is important to have an outward looking dimension and seek synergies between public administrations, as well as external actors. The European Cloud Partnership explores the synergies at European level by coordinating activities and implementing actions using pre-commercial procurement. Inter-operable solutions should be sought in order to avoid lock-in and promote competition.

5. Monitoring and evaluation: The strategies should also incorporate monitoring and evaluation mechanisms, in order to facilitate flexibility in programming management and learning. A typical indicator used in this area is the percentage that public sector and local businesses spend on cloud computing and the share of IT professionals.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/cloud- computing

4.4 Key Enabling Technologies (KETs) for Europe

Why invest in KETs?

The European Commission has defined six priority Key Enabling Technologies[71] for Europe. The Commission has reported that mastering these technologies is regarded as crucial for ensuring the competitiveness of European industries in the knowledge economy. KETs enable the development of new goods and services and the restructuring of industrial processes needed to modernise EU industry and make the transition to a knowledge-based and low carbon resource-efficient economy.

Microelectronics and Embedded Systems:[72] Microelectronics are the lifeblood of 40% of all innovations. Components and Integrated systems are found in virtually all electronic products; from computers and telephones to cars and buildings. The global turnover of the sector alone was around EUR 230 billion in 2012. Despite the current economic climate, the worldwide market for micro- and nano-electronics has grown by 5% per year since 2000. Further growth of at least the same magnitude is predicted for the remaining part of the current decade. In Europe, more than 240.000 people are directly employed in micro- and nano-electronics. Another aspect of why it matters is the establishment of European networks of embedded system design centres which are driven by the vision of "embedded ICT everywhere" and which stimulate connecting innovators across the value chain and across sectors and regions by conducting a critical mass of design and application experiments in application areas such as time-critical systems, or smart environments. In the coming years the market for the Internet of things will further develop, unlocking new economic growth and employment for the European regions. The connected car and smart buildings are only two examples representing EUR 730 billion in revenue.

Photonics:[73] Photonics is everywhere around us: from communications and health, to lighting and photovoltaics and to everyday products like DVD players and mobile phones. Photonics is a fast-growing business sector, with a global market of around EUR 350 billion, projected to reach over EUR 600 billion by 2020. Europe has established a strong position with an overall total share of approximately 18% (€66 billion in 2012).[74] The European photonics industry employs more than 300,000 people directly, many of these in the over 5,000 photonics SMEs often structured in national and regional innovation clusters which represent a highly educated workforce.

Robotics:[75] Robotics has a huge potential to contribute to growth, job creation and to solve major societal challenges. In particular, regions should fully exploit the potential in contributions to local economies, for instance advanced robotics technologies with increased flexibility can play a key role in making local manufacturing and production competitive again,[76] while also contributing to a greener economy, with the potential to re-shore some industries (e.g. food supply). The health and monitoring domains also show great potential at regional level, since these cannot be delocalised.

Manufacturing:[77] The economically driven concentration processes in terms of size and localisation in today's manufacturing industries have led to regional concentrations of actors along value chains in a smaller number of lead regions in Europe. Less developed regions have little opportunity to participate in value creation. ICT allows the creation of 'virtual' value chains regardless of the geographical location of its actors which allow the potential of skilled labour forces in other regions to be exploited, thereby making those regions participate in value creation, often at lower cost. To achieve this, a Smart Specialisation Strategy is key: the aim is to identify and strengthen the competitive advantages of EU regions in terms of skills, R&D capability, industrial output and infrastructures and to link up R&D&I strategies at regional, national and European levels while offering incentives for growth and differentiation. The aim is to leverage the available resources through a European programme and to counter Europe's de-industrialisation.

Barriers & challenges

The key challenge for regions is to make an economic assessment of how the strengths of different sectors can be used to create regional growth and jobs. This will allow them to identify the economic niches and competitive advantages in development and which deployment activities to carry out. To be able to use EU Regional funds such as ERBD the regions will have to assess how KETs can contribute to the creation of growth and jobs. The region should build on their strength and be sure to maintain excellence where their leading position is acknowledged. Regional specialised investment allows excellence to be maintained and new economies developed around them.

71 COM(2009) 512: KETs are knowledge-intensive and associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly-skilled employment. They enable process, goods and service innovation throughout the economy and are of systemic relevance. They are multidisciplinary, cutting across many technology areas with a trend towards convergence and integration.

72 http://s3platform.jrc.ec.europa.eu/documents/10157/130815/130620%20A4%20Fiche%20KETs%20Micro %20electronics%20-%2018%20June%20v1.pdf.

73 http://s3platform.jrc.ec.europa.eu/documents/10157/130815/130620%20A1%20Fiche%20KETs%20Phot onics%20-%2019%20June.pdf.

74 EPIC/TEMATYS Report, Photonics Ecosystem in Europe, April 2013.

75 http://s3platform.jrc.ec.europa.eu/documents/10157/130815/Robotics%20and%20KETS%20special.pdf.

76 Industrial robots can save production locations and millions of jobs. www.ifr.org/news/ifr-press-release/robots-to-create-more-than-a-million-jobs-by-2016-295.

77 http://s3platform.jrc.ec.europa.eu/documents/10157/130815/130621%20A3%20Fiche%20KETs%20Manu facturing%20and%20embedded%20systems.pdf.

The challenge is to identify the topics and candidates for smart specialisation, then develop an ecosystem around them by mobilising all the necessary actors including academia, system integrators, industry, SMEs, potential users, involving local governments, as users, where relevant. The idea is to develop cooperation along the entire R&I value chain, attracting additional investment, sparking entrepreneurship to create new companies, attracting new users, creating new jobs, involving local SMEs and local authorities (e.g. as users to test the technology in public spaces, services, in pre-commercial procurement). Furthermore, sharing physical infrastructures and resources not only at regional but at European level has many advantages, reinforcing the leading position of the region, and also optimising resource and funding at EU level.

How to act?

It could be very useful for regions wishing to develop regional strengths to consider the following elements.

1. Analysis: Identify the main fast growing industrial sectors and the main stakeholders in your region (industry, incl. SMEs and end-users, universities, research institutes, competence centres, etc.); make a SWOT analysis of their capabilities and skills as well as of their competitive advantages; in particular, assess the opportunity in affecting the innovation potential of user industries excelling in application areas and industrial sectors present in your region;

2. Governance/stakeholder involvement: Engage with the stakeholders. Examples of potential lines of action are provided below.

3. Priority setting: Together with relevant stakeholders set strategic R&I priorities (as expressed in your RIS3 operational programmes).

4. Policy mix: Develop roadmaps to reach the set goals, and define implementation actions for the main actors to work together and spur forms of innovation or specialisation. Identify and link with other EU level activities to help your stakeholders find opportunities for cooperation and growth outside your region. A proposition for a number of possible lines of action is listed below.

- Structuring the regional stakeholders around a cluster organisation: cluster organisations can play a pivotal role in promoting R&I investment in a region, by bringing together main industry and academic stakeholders, investors and government agencies with the aim of generating synergies among the players in R&I in specific markets; and, stimulating the creation of business ecosystems that build on complementarities between the different players, including users, with a view to creating new competitive advantages.

- Linking value chain activities through cross-cluster and cross-region cooperation: Full value chains do not exist in many regions. Cooperation between players and end-users in different clusters of a region or in different regions provides opportunities to work along full value chains to expand the business of local industries.

- Supporting innovative SMEs: Regions can support SMEs competitiveness and growth by: (i) stimulating access to regional / European feasibility, testing, prototyping and manufacturing capabilities for research-intensive and end-user SMEs; (ii) stimulating R&I activities involving SMEs both as part of the value chain collaboration and through specific actions aimed at SMEs. In particular, open innovation models along the value chain can further promote the collaboration between large industry and SMEs; (iii) by supporting the development of open-access pilot line and foundry services that provides SME access to manufacturing capabilities.

- Supporting Manufacturing Platforms & Pilot Production Lines: Regions could explore opportunities to promote manufacturing.

- Supporting Large Scale Deployment Actions: public authorities can act as first users in large scale demonstration actions and public procurement schemes that promote innovation for an effective field testing and deployment of innovative technologies. .

5. Monitoring and evaluation: Relevant key performance indicators for KETs in general are provided both in the KETs high level group report and the KETs observatory feasibility study.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/kets-and-manufacturing

5. ICT Services, Applications & Products

5.1 eHealth

Why invest in eHealth?

eHealth implementation is identified by the Commission as one of the Societal Challenges for the upcoming decades. It covers the ICT-based interaction between patients and health-service providers, institution-to-institution data transmission, peer-to-peer communication between patients or health professionals. It also includes health information networks, electronic health records, tele-medicine services, including personal wearable and portable communicable systems for monitoring and supporting patients. Today, healthcare expenditure accounts for 9 % of GDP, but represents between 12% and 15% of government spending in most EU countries. As such, eHealth, with its promise of more efficient care, is critical to the sustainability of the healthcare systems in Europe.

Regions should invest in eHealth, in order to move towards a "European eHealth Area", helping to further coordinate actions and promote synergies between related policies and stakeholders. This could help develop better solutions, prevent market fragmentation and improve the dissemination of best practices. Specific objectives such as creating an electronic health record architecture supporting the exchange of information, the set-up of health information networks between points of care to coordinate reactions to health threats, the promotion of online health services such as information on healthy living and illness prevention, and development of teleconsultation or ePrescribing, are relevant actions. This should be client-centric and tailored to local and regional needs. Digital education is important to support citizen and client initiatives.

It is also crucial to invest in eHealth solutions that reduce levels and length of hospitalisation, for regions with a low population density, or with widely dispersed communities, as eHealth can be more cost effective than the traditional hub-and-spoke hospital model.

Health Innovation Platform[78] - One of the most remarkable examples of using ESIF for eHealth can be found in Galicia, and the "Health Innovation Platform". The platform supports projects that develop innovative healthcare through Public Procurement of Innovation (PPI) mechanisms. The platform has also developed the IANUS system of electronic medical records that makes clinical information available to all health centres and hospitals and to all pharmacies in Galicia (in total 36,000 healthcare professionals are connected).

epSOS – European Patient Summary Open Services - EPSOS aims to design, build and evaluate a service infrastructure that demonstrates cross-border interoperability between electronic health record systems in Europe. There is a regional implication in this project, and Structural and Investment Funds may help in the take up of such solutions.

Noord Brabant (NL) - Smart Care programme focused on eHealth and ambient assisted living (2008) - Vision of future-proof care, independent living but also social inclusion with 16 network projects subsidised by region to implement tested tools across region: social organisations + end user + commercial party.

78 http://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/20120403_galicia.pdf.

Barriers & challenges

The eHealth Action Plan 2012-2020 and its staff working paper recall that the main barriers to deploying eHealth solutions are (a) the lack of awareness and confidence in the benefit of eHealth, (b) the lack of user-friendly eHealth solutions, (c) the lack of interoperability between eHealth solutions, and (d) the limited large-scale evidence of the cost-effectiveness of potential improvements in healthcare processes.

Structural and Investment Funds may be a useful source for funding eHealth solutions, (ideally complementing other instruments such as PCP (Public-Private Partnerships), PCP (Pre-Commercial Procurements) and/or Procurements of Innovative Solutions) to open up new opportunities for local and regional primary and secondary care, healthcare professionals, eHealth industry as well as local and regional government authorities.

How to act?

Regions wishing to invest in the eHealth domain should consider the following steps:

1. Analysis:

a. Assess the regions concerned through a SWOT analysis, and propose specific ways in which they could benefit from eHealth projects and programmes.

b. Determine how this implementation could contribute to other European Commission policies (e.g. eInclusion).

c. Provide a cost-benefit analysis with a different time scale (short-, middle- and long- term) and investigate the potential sources of public and private financing.

d. Determine the necessary human and technical resources.

e. Find, promote and support successful projects and sustainable business models.

2. Governance/stakeholder involvement: The public regional and national authorities should engage with relevant stakeholders. The main stakeholders for eHealth are:

- The eHealth Governance Initiative (Until 2014);
- The eHealth Network (from 2012);
- The CEF Governance (from 2014);
- ICT Standards Multi Stakeholders Platform (From 2012);
- The public sector, such as national/regional authorities in charge of ICT and health, would need to be involved and form the relay to the eHealth Governance Initiative at the regional and local level;
- Healthcare providers (e.g. hospitals, healthcare professionals…) – as care givers;
- eHealth solution providers (start-ups, SMEs, large companies) – as solution providers;
- Patients and citizens at large – as care beneficiaries.

3. Priority setting:

a. Position your level of ambition *vis-à-vis* the relevant Digital Agenda Action (Action 76: Propose a recommendation to define a minimum common set of patient data; Action 77: Foster EU-wide standards, interoperability testing and certification of eHealth).

b. Prioritise projects with the highest foreseeable impact, as defined in the eHealth Action Plan 2020 objectives:

- Strengthen effective prevention and health promotion practices, and improve chronic disease and multi-morbidity (multiple concurrent disease) management;
- Increase sustainability and efficiency of health systems by unlocking innovation, enhance patient/citizen-centric care and citizen empowerment; and encourage organisational changes;
- Foster cross-border healthcare, health security, solidarity and universality;
- Improve legal and market conditions for developing eHealth products and services.

c. Establish roadmaps to reach the defined goals.

Regions are encouraged to help the take-up of successful EU funded projects as they are the prime beneficiaries of their activities, both in terms of the wellbeing of their citizens and the sustainability of their health and social services.

4. Policy mix: In this process, regions should also seek synergies with other national and regional initiatives and EU activities. Of particular interest in this area could be:

a. FP7/H2020 programmes and instruments (PCP, PPP);

b. Current CIP ICT Policy Support Programme;

c. Connecting Europe Facility (2014-2020), supporting inter-alia interoperability aspects (e.g. wider deployment and operations of EPSOS infrastructures);

d. A comprehensive national eHealth strategy should be developed to support the implementation of eHealth services, in line with the eHealth Action Plan and Digital Agenda.

5. Monitoring and evaluation: The Commission calls upon Member States and regions to further develop their planning and monitoring of eHealth services implementation and provides a number of targets.

Further reading

http://s3platform.jrc.ec.europa.eu/ehealth

5.2 Digital aspects of active & healthy ageing

Why invest in Active and Healthy Ageing?

Active and healthy ageing (AHA) is one of the societal challenges we will be facing in the upcoming decades. Demographic ageing heavily impacts on society and economy. The ratio of working people versus inactive people will shift from 4:1 to 2:1 in 2050 and a shortage of up to 2 million jobs in care and health is projected to emerge already by 2020. EU-wide public spending on pensions, healthcare, long-term care, and education will increase by around 20% between now and 2060, while expenditure on long-term care is expected to double in that period. Smart innovation with ICT can help turn the ageing challenge into an opportunity, to achieve a triple win: better quality of life for older citizens and their carers, more efficient and sustainable care systems, and new market opportunities and economic growth. Ageing should drive innovation, tapping into a big and growing 'silver market'. Regions and member states have to address this challenge of ageing by coming up with solutions that really work and at the same foster regional growth.

Digital applications of AHA span across a wide range of sectors such as healthcare (tele-health, tele-care & ambient assisted living), social policy and age-friendly environments (mobility, transport & social inclusion). The services are underpinned by a wide range of hardware and software.

In FP7 and the Competitiveness and Innovation Framework Programme (CIP), around EUR 80 million were dedicated to ICT and AHA research and innovation. Structural and Investment Funds can be used to deploy large scale infrastructures and services for AHA, along the targets of the respective European Innovation Partnership (EIP).[79] In fact, they can be the prime funding source for large scale deployment for those regions which are eligible, such as regions and Member States in South and East Europe. Given the high initial costs of many AHA projects, ESIF can help to kick-start them. It is possible to seek support in ESIF for deployment of EIP related services, under the priority lines of e-services or innovation for example. Also in countries with national OPs, regions can influence the priorities in the new funding period by talking to their national administration.

The **Maltese Union of Midwives and Nurses (MUMN)**[80] has received EUR 1.2 million of Structural Funds to implement integrated care systems, promote continuity of care based on proactive and personalised community/ home-based care, improve the health status and quality of life of the targeted population, and support the long-term sustainability and efficiency of the healthcare system.

79 http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing&pg=%20 commitment.

80 http://www.mumn.org.

Barriers & challenges

The EIP on Active and Healthy Ageing is designed to help overcome barriers and create scale, combining demand and supply side innovation. As the 2010 stakeholder consultation on AHA[81] pointed out, regional action is needed to overcome innovation barriers. The key obstacles are: (a) aversion and non-involvement of end-users as well as lack of end-user training, (b) lack of funding, (c) authorities not promoting innovation, (d) lack of evidence or scattered evidence and (e) problems with patents and standards. Apart from this, cultural differences between different actors – such as service providers, health care and industry – may make it difficult to agree on joint AHA initiatives.

How to act?

1. Analysis: It is important to have (a) an adequate ICT infrastructure; (b) societal and individual acceptance/right incentives, and (c) a good business model and the right policies that allow for a systemic change in health and care for elderly people.

2. Stakeholder involvement: In this area it can be relevant to interact with regional/local governments, health and care authorities and service providers, hospitals, homes for the elderly, insurance companies, patients and older people and their representative organisations, social and health care professionals and their organisations and large, medium and small industry. In fact, all those that are needed for the large scale introduction of new ICT-enhanced products and services for active ageing, from R&D to market introduction to policies for innovation, health and age-friendly environments. The required multi-stakeholder-approach is being practised by the Commission in initiatives like the Ambient Assisted Living Joint Programme[82] and EIP AHA.

3. Priority setting: In the Strategic Implementation Plan for the EIP AHA, the Steering Group has recommended 6 specific actions[83] that are being taken up by the corresponding Action Groups:

- Innovative ways to ensure patients follow their medication prescriptions.
- Innovative solutions to prevent falls and support early diagnosis for older people.
- Prevention of functional decline and frailty, with a focus on malnutrition.

81 http://ec.europa.eu/health/ageing/docs/consult_report_en.pdf.

82 http://www.aal-europe.eu.

83 http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing&pg=%20commit ment#action_plans.

- Integrated care models for chronic diseases amongst older patients, e.g. by remote monitoring and integrating social and health care.

- Interoperable ICT-independent living solutions to help older people stay independent, mobile and active for longer (coupled with an action for global standards).

- Age-friendly environments: innovative living spaces in support of an ageing population.

Regions and Member States are encouraged to engage with the EIP and the AAL JP as they are the prime beneficiaries of their activities, both in terms of the wellbeing of their citizens and of the sustainability of their health and social services.

4. Policy mix: The next step is to develop a roadmap with accompanying activities and policies. These should be aligned with private actors, national, regional and EU policy programmes and activities, such as H2020/COSME and the European Social Fund. It is important to use existing and widespread standards for tele-medicine and other fields to build upon. Furthermore, the roadmap should be related, if appropriate, to existing national innovation schemes and the planned EIT Knowledge and Innovation Community on healthy living and active ageing.[84]

An outward looking dimension is imperative in order to seek synergies with external actors and work towards clearing pending issues in inter-operability and standards. Interregional cooperation is deemed beneficial to gain efficiencies in the design and implementation of innovative services, e.g. through coaching between regions, exchange of good practices, lessons learnt etc. CIP pilot projects are typically based on interregional cooperation and so do AAL JP projects, which require parties from at least 3 Member States to be represented in their consortia. Examples are DART, age-friendly-counties and health for growth. There is an upcoming EIT KIC on healthy ageing.

Galician Health Innovation Platform[85] - The public health authority of Galicia (Spain) has received EUR 80 million of Structural Funds to support projects that develop innovative healthcare through public procurement of innovation. The platform has also developed the IANUS system of electronic medical records that makes clinical information available to all health centres and hospitals and to all pharmacies in Galicia (in total 36,000 healthcare professionals are connected).

5. Monitoring and evaluation: Typical indicators used in this area are measurements of improvements in quality of life for citizens, extra years of living actively and independently at home, number of healthy life years, efficiency gains in care systems and impact on growth and job creation associated with these markets. As part of the EIP-AHA an impact measurement framework is under development which is defining key output impact indicators which could also be used.[86]

Further reading

http://s3platform.jrc.ec.europa.eu/active-and-healthy-ageing

84 http://europa.eu/rapid/press-release_IP-11-1479_en.htm?locale=en.

85 http://www.ehtel.org/references-files/ehtel-symposium-2012-files/EHT12%20S3-4%20Javier%20Quiles% 20-%20Galician%20Health%20Innovation%20Platform.pdf.

86 http://is.jrc.ec.europa.eu/pages/TFS/MAFEIP.html.

5.3 eGovernment & online public services

Why invest in making public services available online?

The Commission Services recommend (Annual Growth Survey 2012)[87] that Member States should give priority to ensuring that exchanges between administrations and enterprises as well as citizens can be done digitally, in order to increase administrative efficiency, transparency and the quality of service. Online public services can be particularly beneficial for SMEs and should be adapted to their needs. The positive effects on administrative efficiency, transparency and quality of services are likely to have positive spill-over effects on the private sector's competitiveness, and thus also have a positive impact on employment. These benefits will be there for national, regional and local levels.

Barriers & challenges

Europe is diverse, and different cultural, political and economic settings contribute to varying barriers and challenges which can again lead to different approaches to achieve shared goals. Bearing these differences in mind, this note presents some potential barriers, priorities and ways forward. Benchmarks show that a wide range of basic public services are available online in almost all EU27 countries. The use by enterprises is increasing and the latest survey indicates that 84% of enterprises use online public services. The take-up of online public services by citizens does, however, remain relatively low and seems to be stagnating in some countries. In 2011, they were used by 41% of EU citizens. This is a challenge when it comes to getting the best use of the considerable investments that have been made in digitising public administrations.

Member States are therefore encouraged to use Structural and Investment Funds to increase the use of eGovernment services by citizens. One key objective of the Digital Agenda for Europe[88] and also the eGovernment Action Plan 2011-2015[89] is that by 2015, 50% of EU citizens will have used eGovernment services.

The following 4 main barriers have been identified by the eGovernment Benchmark report 2012,[90]

1. Lack of awareness: 21% of the respondents indicated they were unaware of eGovernment services. Awareness can be increased by communication and information campaigns, tailored to specific segments. Key segments include those at risk of digital exclusion; younger people (especially students), who are more skilled, able, and willing to use eGovernment however are less aware that relevant online services exist.
2. Lack of willingness to use: 80% highlight this as one of the arguments for non-use. This group consists of relatively more women and older people; however 62% of them are daily Internet users.
3. Lack of trust to use: 11% are non-users due to concerns about protection and security of personal data. Perhaps lower than one might expect. All user groups are more or less equally represented.
4. Lack of ability to use: 24% cite concerns of ability as reason for non-use. These barriers to use need more than straightforward communication.

To overcome these barriers, governments must deliver services that are easy to find and easy to use. This, in conjunction with a focus on eSkills to address the 'ability' barrier, can increase take-up.

How to act?

Regions wishing to invest in making public services available online should consider the following 5 steps:

1. Analysis/benchmarking: MS/Regions should benchmark their activities according to the eGovernment Benchmark 2012 Framework[91] which aligns the Benchmark work in the area of eGovernment with the eGovernment Action Plan 2011-2015.[92] It evaluates the Action Plan across all four policy priorities through a multi-dimensional framework. It focuses on a new set of domains of government activity and assesses many of them in-depth, from the viewpoint of the user (either business or citizen). The 2012 Benchmark report,[93] which was published early 2013, provides insights on progress in the areas of the Action Plan.

2. Governance/stakeholder involvement: Public regional and local authorities should engage with relevant stakeholders. These stakeholders may vary but could typically include:

- public sector authorities at national, regional and local level;
- private sector companies, both as users and developers;

87 http://ec.europa.eu/europe2020/pdf/ags2012_en.pdf.

88 http://ec.europa.eu/information_society/digital-agenda/index_en.htm.

89 http://ec.europa.eu/digital-agenda/en/european-egovernment-action-plan-2011-2015.

90 https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/eGov%20Benchmark%202012%20insight%20 report%20published%20version%200.1%20_0.pdf.

91 https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/eGovernment%20Benchmarking%20method% 20paper%20published%20version_0.pdf.

92 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0743:FIN:EN:pdf.

93 https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/eGov%20Benchmark%202012%20insight% 20report%20published%20version%200.1%20_0.pdf.

- international organisations (e.g. OECD);
- standardisation bodies;
- non-governmental organisations (e.g. Transparency International).

3. Priority setting: Increasing customer centricity for public services will increase online take-up. Customer-centric service design should start by gaining deep insights into the most relevant citizens segments for each specific region, for example for students in a region with several universities or for senior citizens in a region inhabited by a significant number of pensioners, and also prioritise service personalisation as much as possible. This can be done by governments at local, regional and national levels, deploying user data to offer individual and, where relevant, automatic services, as well as permitting users to adjust or design their own service portfolio through 'MyPage' type approaches.

High levels of accessibility and usability reduce the number of steps and make the eGovernment process as automatic as possible through the reuse of user data via the 'once-only' principle. Focus should be given on simplifying so called life event services which, from the users' perspective, seamlessly combine online services from different government entities.

Conscious efforts should be made to save users time and, where appropriate, money. Such benefits can be measured and the results published. Much can also be achieved through offering simple user support, such as short 'how-to' videos, online chat, links to additional information like 'what to expect' information and FAQs, and the possibility of instant feedback.

The deployment of so called 'big data' is increasingly important, and local and regional authorities should also be aware of the potential of incorporating the users' own data, crowd-sourced data, and relevant data from legitimate third parties. In the near future much of this data will be accessible in the cloud and available for use by many stakeholders, not just governments, to develop and co-create their own services.

Improved eGovernment services at local and city levels attract both greater use and increased trust, not least because of their greater relevance and closeness to daily life. Most current eGovernment services are the so-called basic services which enable governments to achieve their national statutory obligations, and most of these are already widely available to a high standard.

There is significant potential, already recognised in many localities, for a large number of 'extended' value adding services in areas like health, social care, education, employment, transport, environment, etc., which many users can benefit from quite frequently. Such 'everyday' services are often location-driven and may involve mobile devices. They can be tailored depending on where users are, who they are, and what they are doing.

To overcome security concerns and lack of trust in digital transactions, e-signatures and e-invoices can be important tools to support the functioning eGovernment services and eCommerce.

The combination of the above-mentioned factors provides a solid business case environment for the development and deployment of public services at local and regional level.

4. Policy mix: The development of a Digital Single Market is an important political priority. A well-functioning Digital Single Market requires cross-border digital public services, linking up the current systems that have been developed on a national level. EU-wide implementation of cross border services is a central component of the eGovernment Action Plan 2011-2015.[94] There are strong potential synergies between Structural and Investment Funds and the envisaged Connecting Europe Facility (CEF) for modernising administrations at all levels. Member States should actively encourage their local and regional authorities to be fully and effectively involved in the deployment and promotion of cross-border digital service. ESIF can provide funding at regional and local level for the development of CEF-DSI enabled cross-border digital services that will be linked to the national and EU infrastructures.

5. Monitoring and evaluation: MS/regions should benchmark their activities according to the eGovernment Benchmark 2012 Framework[95] which aligns the Benchmark work in the area of eGovernment with the eGovernment Action Plan 2011-2015. For specific projects, a focus on benefits should be established from the start and measuring these benefits throughout the project should be part of the project plan.

Further reading

http://s3platform.jrc.ec.europa.eu/egovernment

94 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0743:FIN:EN:pdf.

95 https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/eGovernment%20Benchmarking%20method% 20paper%20published%20version_0.pdf.

5.4 Intelligent transport systems

Why invest in intelligent transport systems?

There is a strong interrelation between intelligent transport systems (ITS) and regional development. Smart, sustainable and safe transportation by using ICT addresses many regional policy priorities. They aim at improving liveability, sustainability, economic growth and safety. By ensuring the scale-up and replication of these systems, regions address one major cornerstone in reaching the 20/20/20 energy and climate goals.

Given increasing urbanisation trends, transformations towards knowledge-intensive economies, growing shares of resource consumption and emissions, regions are under big pressure and in global competition. Intelligent transport systems are key to success in this competition. Transforming current transportation infrastructures and systems into intelligent transport systems requires considerable investment and effort, especially in those regions with obsolete infrastructures. In addition, since the debt crisis has hit many regions severely it can be almost impossible for some regions to face those huge investments.

Sud-Muntenia,[96] Romania: Sophisticated European railway signalling equipment is to be tested on a short section of rail line in southern Romania. The 4.5-year project will pave the way for country-wide rail modernisation, while ensuring safer, faster and more efficient international railway services and connections.

EU Cohesion Policy can provide support for research and innovation in this area. The participation of the Structural and Investment Funds to the implementation of intelligent transport solution projects can contribute to achieving smart growth in all regions. Given the complexity, size and socio-economic and environmental impact of projects, strict conditions and synergies with other actors and funds are essential for achieving common goals.

Barriers & challenges

The transformation towards intelligent transport systems is not an easy task. Regions vary greatly because of the historical, geographical and climate characteristics, the socio-economic fabric, the institutional organisation, the geospatial structure, and the state of its infrastructure etc. At the same time, there are several common and recognizable challenges, which can be tackled by joining up the most relevant actors, from the private and the public side, so as to maximise their impact.

Switching to intelligent transport systems requires huge investment, both to create/renovate the physical and technological infrastructure and to invest in digital systems. Different sets of funding schemes are necessary to implement investments, at both national and European level. In addition, new integrated and sustainable business models are necessary to take the incorporation of innovation into business models into account; a modernisation of public procurement is necessary to fasten the process.

Each region is unique and each country/region has its own institutional setting. Before carrying out any investment, a careful analysis of the specific institutional and regulatory framework must be carried out, to also spot the specific regulatory barriers, preventing innovation and the switch to smart cities.

Intelligent transport systems require huge amounts of data, which are a valuable tool to developing applications. It is important to ensure that data are accessible and trustworthy.

ITS require the interconnection of sectors, essentially transport and ICT but also energy. Therefore, inter- and intra-system interoperability must be a condition for rolling out intelligent transport systems. Finally, data needs to be comparable across regions and countries and KPIs are needed.

Intelligent transport systems require stronger involvement and engagement of citizens in planning processes which should be reflected in decision-making processes and urban planning, based inter-alia on ICT systems.

How to act?

Regions wishing to invest in the intelligent transport systems should consider the following steps:

1. Analysis: (a) to carefully analyse the institutional, regulatory and financial setting of the specific city/region (b) to spot the specific bottlenecks and barriers (c) Estimate the cost of investments to switch to intelligent transport systems, investigate the potential sources of public and private financing and to draw the new sustainable business models necessary to switch to smart cities; (D) to determine the available skills and necessary resources.

2. Governance/stakeholder involvement: Public regional and local authorities are the active and passive actors of the process. They are stakeholders and final users at the same time. Public administration should engage with for example:

- iMobility Forum;[97]
- European Technology Platform ERTRAC;[98]

96 http://ec.europa.eu/regional_policy/projects/stories/details_new.cfm?pay=RO&the=60&sto=2138&lan=7&region=ALL&obj=ALL&per=2&defL=EN.

97 http://www.icarsupport.eu/esafety-forum.

98 http://www.ertrac.org.

- European Innovation Partnership Smart Cities and Communities;[99]
- Smart Cities Stakeholder Platform;[100]
- Green Digital Charter;[101]
- Covenant of Mayors.[102]

Also, public administration should consider replicating existing intelligent transport systems, tested, demonstrated, verified in other locations, which can be easily implemented at lower cost.

3. Priority setting: (a) Regions/cities, can position their level of ambition *vis-à-vis* the two Communication goals and on the Strategic implementation Plan and set their indicative targets for 2015; (b) to carry out the investments needed for intelligent transport systems, it is important to establish a specific roadmap to reach the defined goals, based on the analysis conducted previously.

4. Policy mix: The implementation of innovation transport systems will be done by all the concerned actors at different levels. Regions may consider the White Paper on Transport and the EIP Smart Cities and Communities.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/intelligent-transport-systems

99 http://ec.europa.eu/eip/smartcities.

100 http://eu-smartcities.eu.

101 http://www.greendigitalcharter.eu.

102 http://www.conventiondesmaires.eu/index_fr.html.

5.5 Smart cities

Why should regions invest in smart cities?

There is a strong interrelation between smart cities and the regional and urban development as well as between smart villages and regional and rural development. Cities are microcosms which condense many regional policy priorities and have some specificities to be addressed, as some urban areas today face many difficulties including significant levels of poverty. Smart cities aims at improving liveability and sustainability of cities, by ensuring scaling up and replicating smart city solutions, which will help reaching the 20/20/20 energy and climate goals in cities.

Given increasing urbanisation trends, transformations towards knowledge-intensive economies, cultural trends and growing shares of resource consumption and emissions, cities become even more of a focal point for achieving economic growth, social inclusion and environmental sustainability. All this puts cities under great pressure, especially in times of very tight public budgets. Transforming European cities toward more sustainable objectives requires considerable investment and effort, especially for those cities which have obsolete infrastructures, or are not technologically ready. In addition, facing those huge investments may be almost impossible for cities and regions, because the debt crisis has hit many municipal budgets severely. The decarbonisation efforts of cities risk being delayed by falling tax revenues and austerity measures. This will also negatively affect industries in the low-carbon sector, employment and ultimately adversely hit the economy, as energy, transport and ICT are core economic sectors.

In this picture, the Commission published a Communication on Smart Cities and Communities[103] in July 2012. The goal of the Smart Cities and Communities Innovation Partnership (EIP SCC) aims at tackling some common challenges affecting cities. Its goal is to exploit the untapped innovation potential and to catalyse commercial deployment of smart city solutions in the key economic (and most risky) areas of energy, transport and mobility and ICT. The EIP will act on two fronts, on the demand and supply side:

- The demand side measures include the identification and validation of new business models, new approaches to public procurement and identifying and converging on regulatory measures and standards.

- On the supply side, the EIP will implement a limited number of large scale projects (the Lighthouse projects), at the intersection of transport, energy and ICT, targeting large-scale demonstration of SCC concepts in city contexts, where existing or very near-to-market technologies will be integrated in innovative ways. Yet, commercial roll-out in city environments is also within scope inasmuch as the projects are to prepare the ground for it.

Given the complexity, size and socio-economic and environmental impact of the projects, strict conditions, and synergies with other actors and funds are essential to achieve your goals. In this context, ESIF are fundamental co-instruments to achieve innovation, sustainability and smart cities goals. As already announced in the Communication, the large scale projects foreseen in the implementation phase of the EIP could be funded from a number of sources: EU funding including H2020, ERDF and Cohesion Fund, national and regional funding, and private investments. EU cohesion policy can provide support for research and innovation in these areas. The EU rural development policy (EAFRD) can further support investments and innovation in smart villages in rural areas, multiplying in this way the effects achieved by smart cities' developments and brining up additional synergies between the various ESI Funds and making the rural-urban linkages even stronger. The participation of the ESI Funds to the implementation of smart projects can contribute to achieve smart growth in all regions, cities and rural areas.

European Local ENergy Assistance (ELENA)[104] is an instrument that facilitates the mobilisation of funds for investments in sustainable energy development at local level. ELENA is a technical assistance facility offering support for the preparation of quality projects in the fields of energy efficiency and renewable energy sources in urban areas. The ELENA Facility aims at developing investment programmes that can be then replicated in other cities or regions. The similarity of the ELENA instrument with the LHP is that one of its objectives is to increase the capacity of local authorities to develop sound investment programmes of a certain size, normally above EUR 30 million.

Barriers & challenges

The transformation toward a smart city is not an easy task. Each city varies greatly because of the historical, geographical and climate characteristics, the socio-economic fabric, the institutional organisation, the cultural heritage and the retrofitting, etc.; but at the same time, there are several common and recognizable challenges, which can be tackled putting together the most relevant actors, from the private and the public side, to maximise their impact.

There are a number of barriers and challenges of a cultural, economic, and regulatory nature:

- Cultural and governance: Switching to smart cities means primarily a change of behaviour, at citizen level, for public

103 http://ec.europa.eu/energy/technology/initiatives/doc/2012_4701_smart_cities_en.pdf.

104 http://www.eib.org/infocentre/publications/all/elena.htm.

administration rules and processes, and concerning the industry mind-setting. Governance in cities needs to overcome thinking in administrative silos; long-term and holistic policies and initiatives are needed, more citizen-centred. Citizens need to be provided with the right kind of incentives towards behavioural change, as well as with adequate information through several communication channels, to clearly understand what is at stake, why they should participate in decision-making process for their cities and communities, and what the benefits are in the short-, medium- and long-term, not only in economic terms, but also in terms of more comfort and better quality of life. Technology vendors should accompany this cultural change and foster greater citizen engagement.

- Economic: switching to 'smart city' requires huge investment, both to create/renovate the physical and technological infrastructure and to invest in digital solutions. Different sets of funding schemes are necessary to implement smart cities investment, at both national and European level. In addition, new integrated and sustainable business models are necessary to take into account the incorporation of innovation into the business models used. A real modernisation of public procurement is necessary to speed up the process.

- Regulatory: each city is unique and each country/region has its own institutional setting. Before carrying out any investment, a careful analysis of the specific institutional and regulatory framework must be carried out, to spot also the specific regulatory barriers, preventing innovation and the switch to smart cities.

In addition to this, other horizontal issues must be taken into account: (a) Smart cities solutions require huge amounts of data, which are a valuable tool for developing applications. It is important to ensure that data are accessible and trustworthy. (b) Smart cities mean interconnection of different sectors, such as energy and transport. Systems need to communicate with each other. Therefore inter- and intra-system interoperability must be a condition for smart cities. (c) Smart cities cannot afford to think in an 'old-fashioned' manner regarding their strategic thinking. They must use modern, innovative tools in decision-making processes and for urban planning, based inter-alia on ICT solutions. (d) Finally, data needs to be comparable across cities. Key performance indicators need to be developed and agreed.

How to act?

Regions wishing to invest in smart cities should consider the following steps:

1. Analysis: (a) Carefully analyse the institutional, regulatory and financial setting of the specific city/region. (b) Spot the specific bottlenecks and barriers. (c) Estimate the cost of investment to switch to smart cities solutions, investigate the potential sources of public and private financing and draw the new sustainable business models necessary to switch to smart cities. (d) Determine the available skills and necessary resources.

2. Governance/stakeholder involvement: Public regional and local authorities are the active and passive actors of the process. They are stakeholders and final users at the same time. Public administration should engage with:

- European Innovation Partnership EIP SCC governance;

- Stakeholders' Platform[105], a network of 7,000 stakeholders advising and providing feedback to the EIP Board;

3. Priority setting: (a) in October the Commission published the Strategic Implementation Plan with operational targets by 2015.[106] Regions/cities, based on the Communication goals and on the Strategic implementation plan, can position their level of ambition *vis-à-vis* these two strategic documents and they can set their indicative targets by 2015 (b) In order to carry out the investments needed for smart cities solutions, it is important to establish a specific roadmap to reach the defined goals, based on the analysis previously done.

4. Policy mix: Smart cities will be implemented by all the actors concerned, at different levels. In addition the objective of the EIP is to act at demand and supply side. On the demand side, regulatory bottlenecks, new and sustainable business models, the modernisation of the public procurements will be mostly tackled. Regions are encouraged to take part and to seek synergies at national and EU level.

On the supply side, a series of large scale projects will be implemented during the next programming period. The objective is to explore all the different possibilities to co-finance these projects under H2020, ESIF, banking institutions, risk facilities, European Investments Back etc. Regions are encouraged to seek synergies with other possible sources of financing. Also, public administrations should consider replicating existing innovative solutions (e.g. intelligent buildings, lighting, transport and mobility) which have been tested, demonstrated and verified in other locations and can be easily implemented at low cost.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/smart-cities

105 http://eu-smartcities.eu.

106 http://ec.europa.eu/eip/smartcities/files/sip_final_en.pdf.

5.6 Smart grids

Why invest in smart grids?

Energy security and climate change are becoming increasingly prominent on political agendas worldwide, such that they rank among the highest of EU priorities. The EU is aiming for a 20% increase in energy efficiency, raising the share of energy consumption produced from renewable resources to 20% and reducing greenhouse gas emissions 20 %, by 2020.

European Smart Grids will promote the Intelligent Energy Supply Chain that will optimize, control, secure and sustain the procurement and supply of cleaner distributed energy anticipating increased demand till 2020 and beyond. ICT-based innovations will provide one of the potentially most cost-effective means to help Member States achieve the 2020 targets.

Infrastructure renewal and grid modernisation are critical to the economy and economic growth, particularly in a globally competitive environment. The efficient deployment of Smart Grids should exploit synergies between telecommunication and energy operators at infrastructure and services level. Smart Grids offer an opportunity to put broadband infrastructure to dual use (for both broadband and smart energy services), either by the utility itself, or via effective joint undertakings between the energy utilities and telecom operators.

Making use of ESIF will support projects with cost-to-performance ratios that are too high to be attractive for commercial stakeholders. The largest cost component of deploying communication networks (up to 80%) is civil engineering. In addition to facilitating broadband deployment, there is a potential for reducing both costs and environmental impact if synergies are established in the implementation of civil works, for example by the re-use of existing ducts or sharing of infrastructure owned by energy utilities.

On the other hand, to achieve interoperability and interconnection between broadband and energy networks, strong coordination of civil engineering projects and initiatives at European level is essential. The results of studies exploring best practices across Europe will be used in the work of European and international standardisation bodies. In addition, on the basis of best practices, requirements for investments and obligations for co-deployment of infrastructure will be explored. If the right conditions for replicability are put in place, the impact at EU level can be ensured, subject to achieving interoperability.

A number of calls for proposals in the area of Smart Grids have been published by the European Commission within FP7. In addition there are several initiatives at national level, e.g. **E-Energy programme**[107] of Germany. One approach to alleviate fears regarding return on investment and other perceived risks is to support a few "lighthouse projects" that can be used as exemplars to encourage stakeholders to consider collaboration.

Barriers & challenges

Smart energy services rely on investments in deployment of broadband infrastructure at national and cross-border level. Defining and exploiting synergies through forming infrastructure partnerships and through cross-service provision will foster the deployment of smart grids. Such arrangements would provide appreciable efficiency gains (faster deployment at a reduced cost, avoiding unnecessary overlapping of broadband infrastructure), market opportunities and scope for utilities and telecom providers to diversify their traditional business models and move into each other's markets: a win-win situation for all market players and ultimately for EU consumers. However, for various reasons - including uncertainty (esp. for telecom providers) about access to energy consumption data, misgivings of utilities on the capability of telecom providers to offer security and reliability, lack of commercially successful precedents – there is limited market growth to date. If anything, we may end up with a monopoly situation, where utilities build their own data systems and EU-wide interoperability is compromised. One approach to alleviate fears regarding the return on investment and other perceived risks is to support a few "lighthouse projects" that can be used as exemplars to encourage stakeholders to consider collaboration.

Fostering new market players, especially through collaboration between telecom providers and utilities, will develop and offer smart energy services in a competitive market. Therefore, a few "lighthouse projects" are needed to convince the two sectors about the benefits of collaboration and investors about the certainty of recovering their capital.

How to act?

Regions wishing to invest in Smart Grids should consider the following steps:

1. Analysis: (a) to carefully analyse the institutional, regulatory and financial setting of the specific city/region, (b) to spot the specific bottlenecks and barriers, (c) to estimate the cost of investments for deploying Smart Grids solutions, to investigate the potential sources of public and private financing and to draw new sustainable business models and (d) to determine the available skills and necessary resources.

107 http://www.e-energy.de/en.

2. Governance/stakeholder involvement: Public - regional and local - authorities are the active and passive actors of the process. They are stakeholders and final users at the same time in order to implement Smart grids into the European single market and to establish a global leadership in the next generation of energy services. Synergies between telecommunication and energy sectors will be analysed and new business models will be defined for the deployment of smart grids in a cost-effective and efficient way.

Estimating the costs for deploying smart energy communication infrastructures needs to be divided between those networks deployed in urban areas and those deployed in rural areas. The costs depend on the distance from the customer premises to the exchange box as well as on the population density. In urban areas, population density does not make a significant difference to the price per premises. The most expensive part of the network is a sparsely populated rural area.

One of the compelling reasons for facilitating the sharing of the core infrastructures of broadband networks and smart energy networks relates to the high cost of network rollout. The reduction in costs due to the use of alternative/shared infrastructure is significant, especially in rural areas. Due to the fact that the utilities' duct networks are widely available in more rural areas, they will only be able to provide space in existing ducts, so fibre will still need to be installed. Therefore, the costs for optical fibre cables and their installation are assumed to remain unchanged from the base case. The synergies in the networks will cause a reduction of costs up to 50%.

3. Priority setting: (a) The Commission will call for proposals for appropriate lighthouse projects, or projects of common interest, which are to be implemented jointly by utilities and telecom providers; (b) In order to carry out the investments needed for accelerating the deployment of communication infrastructures shared between broadband access networks and smart energy grids, it is important to establish a specific roadmap to reach the defined goals, based on the analysis previously carried out.

4. Policy mix: Different Business models can be considered:

- An energy utility installs broadband infrastructure in parallel to its own infrastructure for energy distribution and deploys it;
- An energy utility installs broadband infrastructure on behalf of a telecom operator;
- An energy utility and a telecom operator jointly install broadband infrastructure and share its use.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/smart-grids

5.7 Open data portals

Why invest in open data?

The central aim of the EU 2020 strategy is to put Europe's economies onto a high and sustainable growth path. To this end, Europe must strengthen its innovative potential and use its resources in the best possible way. One of these resources is public data - all the information that public bodies, at all levels of government, produce, collect or pay for. Examples are geographical information, statistics, business registers, environmental monitoring, education, research, health, cultural heritage and tourism. This information has a significant and currently insufficiently exploited potential for re-use in new products and services, for citizens' information, for efficiency gains in administrations and for economic growth. Overall economic gains from opening up this resource could amount to EUR 40 billion a year in the EU. Also for job creation, open data is significant. Germany's market for geo-information reached an estimated size of EUR 1.4 billion in 2007.

EU Member States have different governmental structures, spanning from highly centralised to completely federal. In all cases, a huge quantity of information is generated by public administrations at regional and local level, with the initial objective of fulfilling a specific mandate. Furthermore, organisations at national level can also support and manage portals that host large amounts of data that would otherwise be beyond the capabilities of any single entity.

With the development of easy and fast instruments for accessing, sharing and exploiting information, and in a context of economic crisis and rationalisation of public investments, the maximisation of public sector information re-use is an invaluable opportunity for improving efficiency and boosting the economy. Increased and easy availability of information will also benefit citizens, improving transparency of local governments and facilitating the development of end-user oriented applications (e.g. multimodal local transport routing).

Moreover, regions and national agencies managing ESIF are bound to publish at least a minimum set of information on funded projects and recipients. This information is crucial for enforcing transparency and understanding how public funds are used and what kind of results regional support policies have achieved. While some regions only release a minimum set of information (beneficiary names and total value of projects), more and more public authorities in Europe are taking current regulations as an opportunity to manage EU funds more transparently.

Barriers & Challenges

There is still a lack of awareness among public organisations of the potential of open data. Concerns regarding privacy protection, the ownership of data and, more generally, the fear of 'losing control' of data are also still an issue. A better understanding of the opportunities linked to the release of open data, and of the solutions available to address real or perceived issues is necessary. This can be facilitated by initiating a thorough and dynamic dialogue between stakeholders, regional and local administrations together with business actors, including SMEs, and the academic community.

Practical and technical issues also need to be addressed. Data may have been generated and stored in different formats and for different purposes; the lack of interoperability makes their reuse and combination difficult. Data also often exist but are not made available, or their discovery is difficult due to a lack of cataloguing information (metadata) and of discovery tools as web portals.

The availability of the already existing information in a machine-readable format, as well as of a basic layer of commonly agreed metadata would facilitate data cross-reference and interoperability, greatly enhancing their value for re-use. The availability of a technical infrastructure to ensure permanent access and availability is also necessary. This infrastructure should be conceived in a modular and flexible way (e.g. cloud computing), in order to allow public administrations with limited IT capabilities (e.g. small municipalities) to also make their information available. Also regions could support municipalities to collaborate to share infrastructure and costs.

How to act?

1. Analysis: Before choosing open data as a priority, regions and Member States should analyse and understand the potential for the public and private sector, for researchers, consumers and citizens. A first step it to analyse where a member state or region stands in comparison to different benchmarks. An example of this is Cap Gemini's Benchmarking of Open Data Initiatives[108] that examines the usability of data portals and data availability.

2. Stakeholder involvement: In order to define the actions and priorities, public regional and local authorities should engage with relevant stakeholders, in particular:

- Re-users (SMEs, non-commercial re-users);
- Citizens, and their associations;
- National authorities to see how regional activities can be linked to their activities;
- Other regions (including where relevant neighbouring regions in other MS), in order to ensure interoperability.

108 http://www.capgemini-consulting.com/sites/default/files/resource/pdf/opendata_pov_6feb.pdf.

3. Priority setting:

- Prioritise actions addressing information with the highest impact (high value datasets, high potential for re-use and creation of innovative applications for business and citizens, relevant information for supporting regional specific developments, already addressed by the requirements of national or European legislation);
- Define action plans able to provide the first tangible results quickly, in order to initiate the process, demonstrate the benefits of making open data available for re-use, sustain further demand and evaluate first impacts;
- Support the creation of added value services based on released open data, in particular addressing Member State/regional policy priorities.

4. Policy mix:

Web portals: Regional and local authorities as well as public bodies and agencies have in recent years begun to set up portals to provide access in a facilitated and harmonised way to a wide range of information generated in the execution of their public tasks, in line with the open data principles (free access to all, with no technical or legal limitations). While open data portals are being developed at national and European level, the availability of regional or even local portals can also be a necessity, allowing targeting of a community with specific interests in a given region, interests than can only be covered in a general way through a national portal. Since portals are front end sites providing references to datasets and end-user applications, and do not contain datasets themselves, information is not duplicated. EU, national and regional portals may exist to serve different purposes, all referring to the same reference datasets usually stored and maintained by the authority responsible for its collection. The same dataset containing information on public transport in a local community, for example, can be referenced by a portal related to this same local community, by a regional portal and by one or more national portals (e.g. in case of areas with high cross-border commuting). Besides giving access to information, portals can also include applications targeting the specificities of the regional or local communities, e.g. in relation to socio-economic activities, or for promoting and supporting developments in specific areas. Regional authorities can draw inspiration from best practice examples of national portals such as the UK data.gov.uk portal.[109]

Applications: On the basis of one or more datasets discovered and made available in a harmonised way, applications can be developed to target citizens' specific user needs, e.g. facilitating their relationships with local public administrations or delivering updated information and services. At regional and local level applications can be focused on delivering services tailored to specific needs which could not be covered on a geographically broader scale. Typical examples are applications providing the location of the closest pharmacy or the availability of public parking, accessible both on the open data portal itself of a local community or as standalone applications for mobile devices.

Open data portal of the city of Ghent[110] - The city of Ghent has developed an open data portal providing a single, comprehensive catalogue of data published by the city, as well as applications for targeting residents and visitors. It also offers functionalities for IT developers, as easy conversion between various data file formats, files in linked data format and interfaces for machine to machine connectivity. To promote the reuse of open data, in collaboration with local, federal and international organisations, competitions for developers ("Apps for Ghent" events) have been organised, where coders and designers meet to use local open data to build applications.

Helsinki Region Infoshare online service[111] - The Helsinki Region Infoshare project aims to make Helsinki metropolitan area information easily accessible to all, i.e. citizens, businesses, universities, academies, research facilities or municipal administration. The project includes building a web service for fast and easy access to open data sources. The European Commission awarded Helsinki Region Infoshare with the 2013 European Prize for Innovation in Public Administration, with the mention that the City of Helsinki opened access to decision making information by opening an interface to its electronic case management system, offering a great opportunity to activate citizens to be more involved in public decision-making.

5. Monitoring and evaluation: Performance indicators suggested for monitoring the development of an open data infrastructure are:

- Number of datasets accessible through the portal;
- Number of datasets published in a highly reusable format (open format, linked data);
- Usage statistics, cost per visit/download;
- Number of newly developed applications making use of released open data, degree of innovation, relevance to national/regional policies;
- Overall economic impact.

Further reading

http://s3platform.jrc.ec.europa.eu/open-data

109 http://data.gov.uk.

110 http://data.gent.be.

111 http://www.hri.fi/en.

5.8 Digitisation of cultural heritage to boost innovation

Why invest in digitisation of cultural heritage?

Digitisation turns Europe's cultural resources into an important building block for the digital economy and provides Europe's Cultural and Creative Industries (CCIs), which already account for ca. 4% of EU-GDP and jobs and have great potential for stimulating innovation in other sectors, with a competitive edge. The digitisation and online accessibility of cultural resources as input for added-value products and services can fuel innovation in areas such as tourism, education, architecture, design, publishing, advertising or gaming. Moreover, it gives Europe's rich cultural heritage a clear profile on the Internet, promotes regions, protects cultural diversity and contributes to better quality of life.

Digitisation and online accessibility lend the collections of museums, libraries and archives much greater visibility. This does not only attract new visitors, tourists and researchers, but also business to regional economies. Digitisation and digital preservation further create employment opportunities in innovative areas such as 3D-capturing, 3D-processing and tools for text digitisation or preservation of audio-visual material. It is estimated that around 20% of Europe's collections have been digitised so far, (though for film heritage[112] the share of digitised collection is only 1.5%).[113] Making use of ESIF to co-finance digitisation activities can thus help regions play a key role in contributing to EU objectives in promoting cultural diversity as well as creative content for jobs and growth. The Czech Republic, Finland, Greece, Latvia, Lithuania, Poland, Slovakia and Sweden have used the Structural Funds for digitising cultural heritage resources.[114] However it is important that the digitisation activities are connected to the regional strategic framework, outlining how this will lead to economic growth and employment opportunities.

e-Paveldas project[115] - One of the most remarkable examples of using Structural Funds for digitising cultural content can be found in Lithuania: the e-Paveldas database contains over 3 million pages of old books, newspapers, artworks, manuscripts and church registers. EU funding amounted to EUR 3.6 million, and the project lasted two and a half years until Summer 2013. The Martynas Mažvydas National Library of Lithuania, the main institution implementing the project, could build on a previous project on library information systems. Apart from preserving Lithuanian cultural heritage and making it easily accessible for free, the project created 32 new jobs in promising new occupations like digitising operators and programmers.

Lithuanian Documentary Cinema on the Internet[116] – The objective is to create an archive of the digitised Lithuanian documentary cinema and to provide a simple and fast online access. It is financed by Priority 3 "Information Society for All" of the Lithuanian Economic Development Operational Programme. The total budget is € 2.7 million.

Nitrofilm project[117] - The aim of this Polish project is to set up a specialised infrastructure for the conservation and reconstruction of the oldest film materials and the digitalisation of a part of the Polish pre-war cinematography collection. It is co-financed from the ERDF (Priority XI Culture and Cultural Heritage) within the framework of the OP on infrastructure and environment. The total cost is EUR 4.8 million, of which around three quarters are EU funding.

Barriers & challenges

The digitisation of Europe's cultural heritage and its preservation is a costly task.[118] With only a fraction (20%) of Europe's cultural heritage digitised, and only a small proportion of all digitised items accessible online, this work is still in its infancy. In their 2010 national progress reports, the vast majority of Member States indicated that public funding for digitisation accounts for about 80% of the costs.[119] Given

112 https://ec.europa.eu/digital-agenda/en/news/cinema-expert-group-subgroup-film-heritage.

113 ENUMERATE Survey Report on Digitisation in Cultural Heritage Institutions 2012; According to the European Association of Film Archives (ACE). http://www.enumerate.eu/fileadmin/ENUMERATE/documents/ENUMERATE-Digitisation-Survey-2012.pdf.

114 Second progress report on the digitisation and online accessibility of cultural material and on digital preservation in the European Union (November 2010) and Third implementation report of the EP and Council Recommendation on Film Heritage (December 2012). http://ec.europa.eu/information_society/activities/digital_libraries/doc/recommendation/reports_2010/2010%20Digitisation%20report%20overall.pdf.

115 http://www.epaveldas.lt/en/web/guest/home.

116 https://ec.europa.eu/digital-agenda/en/news/cinema-expert-group-subgroup-film-heritage.

117 http://www.nitrofilm.pl.

118 The Comité des Sages Report indicates some €100 billion to digitise Europe's heritage. http://ec.europa.eu/information_society/activities/digital_libraries/doc/refgroup/final_report_cds.pdf.

119 The reports indicate Member States' progress towards implementation of the Commission Recommendation of 24 August 2006 on the digitisation and online accessibility of cultural material and digital preservation (2006/585/EC). See also the Recommendation (2011/711/EU) from 29.10.2011, p. 39. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:236:0028:0030:EN:PDF.

the high reliance on public funding for digitisation[120] and the severe cuts to culture budgets as a result of the current crisis, the potential of digitisation's contribution to regional development may not be fully tapped. However ESIF should not replace national or regional funds, but complement these and enable what would not be done otherwise.

How to act?

Regions wishing to invest in the digitisation of cultural heritage should consider the following 5 steps:

1. Analysis: (a) Assess the kinds of cultural heritage material available in their region and in which ways they could be of use once digitised. Can this material serve as input for the Cultural and creative industries CCIs or spur other forms of innovation or specialisation (e.g. educational or cultural tourism)? (b) Estimate the cost of digitisation and investigate the potential sources of public and private financing, including through Public-Private Partnerships (PPPs); (c) Determine the available skills and necessary technological resources. A number of EU-funded projects explore how ICT can facilitate large-scale digitisation and make it more cost-effective:

3D-COFORM[121] - Tools and Expertise for 3D Collection Formation focuses on the digitisation of cultural heritage artefacts and delivers new tools in the areas of 3D-capture, 3D-processing, the semantics of shape, material properties etc., resulting in richer and more realistic representations, better documentation and increased cost effectiveness of the digitisation process.

IMPACT[122] - IMProving ACcess to Text brings together centres of competence in large-scale text digitisation in order to share know-how and best practices and to develop innovative tools enhancing the capabilities of OCR engines and the accessibility of digitised text and to lay down the foundations for future mass-digitisation programmes.

PRESTOSPACE[123] - Preservation towards Storage and Access. Standardised Practices for Audio-visual Contents in Europe - Institutions traditionally responsible for preserving audio-visual collections (broadcasters, research institutions, libraries, museums, etc.) face major technical, organisational, resource-related, and legal challenges in taking on the migration to digital formats and the preservation of already digitised holdings. The project has developed technical tools and a semi-automated integrated system, the 'Preservation factory', for digitisation and preservation of all types of audio-visual collections.

2. Governance/stakeholder involvement: Public regional and local authorities should engage with relevant stakeholders .These actors will vary depending on the potential available in a region, but may include:

- public sector, such as national/regional ministries in charge of ICT, culture, or regional and local governments;
- cultural institutions (galleries, libraries, museums, archives and film heritage institutions) - as content providers;
- CCIs – as re-users of cultural heritage content in applications and added-value services, e.g. in the education, edutainment, design, gaming, and tourism sectors;
- technology firms – as providers of digitisation/preservation technologies;
- Internet actors –such as social networks, online reference works or philanthropic organisations.

An example of a project involving regional and local stakeholders to give their collections greater visibility online is the *EuropeanaLocal* project:[124]

EuropeanaLocal was funded under the eContentplus programme of the European Commission. It involved local and regional libraries, museums, archives and audio-visual archives to make their collections available through Europeana and deliver new services. Consult the list of project participants from your country.[125]

Besides ESIF to co-fund digitisation activities as part of projects having an impact on the regional economy, MS and regions should consider PPPs to create new ways of funding digitisation. Stakeholders may therefore also include companies willing to invest in digitisation:

120 For some key facts and figures on digitisation across the EU see Commission Staff Working Paper; http://ec.europa.eu/information_society/activities/digital_libraries/doc/recommendation/staffworkingpaper1274final.pdf.

121 http://www.3d-coform.eu.

122 http://www.impact-project.eu.

123 http://prestospace.org.

124 http://www.europeanalocal.eu.

125 http://www.europeanalocal.eu/eng/About/Partners2.

BnF-Partenariats, a private company wholly owned by Bibliothèque Nationale de France (BnF), has launched a large-scale 15-year partnership agreement with Proquest LCC (UK) for the digitisation of 10 million pages of ancient books. Already 70,000 works printed in France from Incunabula to 1701 have been digitised in 5.5 years instead of 50 years without the partnership. The National Fund for the Digital Society contributes €5 million. Another large-scale partnership was signed with Believe Digital and Memnon for BnF's sound recordings collection, which corresponds to 1/3 of the estimated EUR 15 million total cost; the remaining 2/3 expected to be covered by the partners and revenue from the commercial exploitation of the digital collection. All the digitised books will be fully accessible for BnF patrons on Gallica's intranet, while 5% will be immediately available on Gallica's website. The partners will have a temporary preferential right (10 years for Proquest) to exploit the corpus of digitised books.

3. Priority setting: (a) Position your level of ambition *vis-à-vis* the *Europeana* project and its indicative targets per Member State by 2015 (see Annex II of Recommendation 2011/711/EU); (b) Establish your RIS3/OP priorities taking into account the expected socio-economic impacts of digitisation of cultural material may have; (c) Establish roadmap to reach the defined goals.

Europeana[126] is the common, multilingual access point to Europe's cultural heritage online, which currently provides visitors with more than 26 million books, paintings, films, recordings, photographs and archive material from over 2,200 partner institutions, including prestigious museums, libraries and archives. Europeana, together with all the related projects, has established an interoperable infrastructure and a thriving cross-border network for digital cultural heritage. Europeana can help local and regional stakeholders capitalise on investments in digitisation and create the conditions to drive innovation and growth. Audiovisual content is particularly appealing for users. Nevertheless, it currently provides access to only 450,974 sound (2% of total) and 167,983 video items (0.75% of total).

4. Policy mix: In this process, regions should also seek synergies with other national and regional initiatives and EU activities. Of particular interest in this area could be: (a) FP7/H2020 programmes that explore i.a. the potential of ICT to enhance creative processes in cultural and educational contexts aim to enhance user experiences with digital cultural resources; (b) Current CIP ICT Policy Support Programme, especially the ones connected to Europeana; (c) Connecting Europe Facility (2014-2020), in particular regarding the deployment of Digital Service Infrastructures which aim at providing trans-European interoperable services of common interest for citizens, businesses and governments.

5. Monitoring and evaluation: The Commission calls upon Member States and regions to further develop their planning and monitoring of digitisation and provides a number of targets. ENUMERATE[127] is gathering statistics on the digitisation of cultural heritage in Europe. It is useful for benchmarking and monitoring. While this is a first approximation, more exact statistics need to be developed for specific sectors, such as film heritage.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/digitisation-heritage

126 http://www.europeana.eu/portal.

127 http://www.enumerate.eu.

5.9 Language resources to make digital single market a reality[128]

Why invest to promote language resources?

The META Language white papers series, published in autumn 2012 indicated that as many as 21 European languages (most of which are official EU languages) are facing "digital extinction" – meaning that relevant and up-to-date online content and online services are not available in those languages (or that the level of service in such "endangered" languages is significantly lower than English or other major languages).[129] However, language technologies such as machine translation (MT) offer opportunities to overcome language barriers in the online domain. The problem is that for the smaller languages (especially for the 21 languages referred to above), the availability of MT solutions is limited, due to limited availability of language resources. This is because language resources are the indispensable "raw material" for producing high-quality MT systems. While EU-funded actions have been undertaken (see META: box below) to create a single access point to a European pool of language resources, this pool is not yet sufficiently populated by high-quality language resources for all EU languages. The possibilities for using EU research/innovation/infrastructure funds to support individual EU languages are limited, as such EU-funded projects typically focus on developing technology, infrastructures and solutions of generic and cross-border European value.

On the other hand, Member States and their regions are best placed to foster language resources for their respective languages. They also have an interest in promoting the status of their languages vis-à-vis other European languages. Very often, the under-resourced languages are also languages spoken in less developed regions.

A well-functioning and systematic use of ESIF to support language resources would contribute to the objectives of the DAE by removing language barriers from the online domain, helping to create a digital single market across the numerous linguistic borders. More concretely, it would support the pan-European multilingual digital services foreseen in the Connecting Europe Facility, by ensuring coverage of all European languages, including the smallest ones, by complementing the "Automated translation" building block foreseen in the CEF proposal. It would also complement more ground-breaking work on improving machine translation quality, foreseen in the draft work programme 2014-15 for Challenge 4.3 of the H2020.

META[130] is a cluster of projects, aiming to build a Multilingual Europe Technology alliance (META-NET), and to create a pool of European language resources (**META-SHARE**).[131] The project has also produced analyses (the Language White Papers) of the situation of EU languages in the digital and online context. META is complemented by regional projects coordinating the collection of language resources in their respective areas of coverage:

- **META-NORD**:[132] Baltic and Nordic language resources;
- **CESAR**:[133] Resources for Central and South-Eastern European languages (including Balkans).
- **METANET4U**:[134] Portuguese, Spanish, Romanian, English, Maltese language resources

Barriers & challenges

While EU projects from FP7 and CIP programmes have supported, to some extent, the initial organisation of language resource collection in Member States, the landscape of language resource coverage has numerous gaps. Typically, the biggest gaps appear for languages (like the East European languages) that have modest support from national budgets, while bigger language groups (EN, FR, ES) are better served and have more language resources, thus, also they are equipped with better automated multilingual solutions like MT.

The involvement of Member States and regions in programming, strategic planning and implementation of EU-funded actions in language technologies and language resources has so far been limited. In many Member States, it has been difficult or impossible to identify contact persons or desk officers that could be involved in EU projects, invited to events or informed of the results of projects.

How to act?

Regions wishing to invest in the language resources should consider the following steps:

1. Analysis: Member states and regions are in a key position for detecting, making aware and mobilising the relevant actors that hold linguistic material and key competences, or operate in local language services markets. The key stakeholder groups are:

128 This area of activity can be an important element of a digital strategy. It might, however, not be eligible for funding through ESIF.

129 http://www.meta-net.eu/whitepapers/press-release.

130 http://www.meta-net.eu.

131 http://www.meta-share.eu.

132 http://www.meta-nord.eu.

133 http://cesar.nytud.hu.

134 http://www.metanet4u.eu.

- Public sector, such as national/regional ministries in charge of ICT, commerce, languages – but also those producing relevant language resources (e.g. translations)

- National language councils and similar bodies, tasked to preserve and develop national linguistic heritage and competences

- Universities and research centres engaged in research in linguistics, language technologies and language resources

- Companies that provide language services (e.g. translation, localisation) or language technologies (e.g. machine translation) for the local/national language(s) and/or for the local/national markets.

2. Governance/stakeholder involvement: It is important to ensure that Member States and regions are involved in and contribute to the planning and implementation of EU actions on language resources, as they have a direct interest in their respective languages. At minimum, Member States and regions should appoint desk officers or representatives to follow European actions and EU-funded projects that coordinate work on language resources and language technologies. Ideally, they would draw up national/regional programs and set up related governance structures to support their language in the digital context, and to seek collaboration with related EU actions.

Member States and regions should coordinate the participation of the stakeholders in their respective geographic areas to EU calls for proposals, calls for tender and to various awareness and coordination activities and events. The national centres in the META-NET can provide information and assistance and propose collaboration in on-going projects and other actions. Member States and regions can propose additional centres of excellence and contact points, especially in case of gaps in representation of a particular language or region.

3. Priority setting: Priority should be given to language resources that fill a gap in coverage (i.e. language(s) and/or topics that are not yet covered). Such gaps are identified in the META-NET Language White Papers. Another basis for prioritisation is to promote high-impact applications, for example, e-commerce sites or e-government systems that serve (or have a high potential to serve) a large number of customers from different language communities. Finally, priority should be given to language resources that serve important policy objectives either at the EU level (e.g. digital single market) and/or at the Member State/regional level.

4. Policy mix: Member States and regions should use the opportunities in policy making and legislation to promote their languages in the EU context. This is especially important for programmes that provide funding for multilingualism, language resources, or language technologies. Also, effective transposition and implementation of the Public Sector Information (PSI) directive will improve availability and re-use of language resources generated by the public sector in the Member States.

Member states and regions often hold linguistic content that has high potential re-use value as language resources. One example is the collections of documents and their translations (e.g. regulatory texts, informative publications, web site content in multiple languages…), as such "parallel corpora" can be used to develop machine translation systems. Another example includes bilingual or multilingual dictionaries, glossaries and terminologies. Such language resources often require conversion and processing to machine-readable format, and, sometimes, more time-consuming annotation, before they can be used to develop machine translation engines and other useful applications. This requires investment of human resources and/or funds.

5. Monitoring and evaluation: Performance can be measured at different levels in the value chain of language resources:

- Number of Member States/regions/language competence centres participating in language resource collection;

- Number of language resources collections, their typology (topical coverage, type of resource) and size (number of words, tokens, gigabytes, segments, records etc.);

- Number of applications (e.g. machine translation systems) developed with the language resources;

- Standardised indicators (e.g. BLEU metrics) measuring the quality of the applications developed with the language resources;

- Size of user base for the multilingual applications, developed with the language resources;

- Economic impact (e.g. revenue generated) by the applications developed with the language resources.

Further reading

http://s3platform.jrc.ec.europa.eu/language-resources

5.10 Investing in network and information security[135]

Why invest in network and information security?

ICT has become the backbone of our economic growth and is a critical resource which all economic sectors rely on. Many business models are built on the uninterrupted availability of the Internet and the smooth functioning of information systems. However, information systems can be affected by security incidents, such as human mistakes, natural events, technical failures or malicious attacks. Cybersecurity incidents are increasing at an alarming pace and could disrupt the supply of essential services. The Commission's online public consultation on 'Improving network and information security in the EU1' found that 57% of respondents had experienced network and information security (NIS) incidents over the previous year that had a serious impact on their activities.

The likelihood and frequency of incidents and the inability to ensure efficient protection also undermine public trust and confidence in network and information services. Across the EU, more than one in ten Internet users have already become victims of online fraud. The 2012 Eurobarometer on Cybersecurity found that 38% of EU Internet users are concerned about the safety of online payments and have changed their behaviour because of concerns with security issues: 18 % are less likely to buy goods online and 15% are less likely to use online banking.

This problem affects all parts of society and economy (national and local administration, business and consumers). In particular, a number of sectors play an essential role in providing key support services for our economy and society. These sectors include banking, stock exchanges, energy generation, transmission and distribution, transport (air, rail, maritime), health, enablers of key Internet services and public administrations.

Security incidents are capable of rendering critical government functions unavailable for several days, as demonstrated by the cyber-attacks against Estonia in 2007, which severely affected not only the provisioning of online services such as e-government and e-banking within the country, but also prevented citizens from accessing online services across borders.

Public networks are strongly interconnected and an incident affecting one entity even at local level can easily spread to another entity. Due to this strong interconnection, a network effect, resulting from incidents affecting a number of similar administrations, even small and local, is more likely in the context of public administrations. Such an effect carries the risk of NIS incidents spreading within or between administrations, which could disrupt or paralyse vast fields of local and national public activities. This risk is increased by the fact that state and local administrations are often targeted by cyber-attacks and are facing very significant and rising NIS risks. Criminals in particular can use a local administration as an entry point to attack other sectors of the administration.

The resilience and reliability of public on-line services to citizens is key to building and preserving their trust in e-government. eGovernment and eParticipation are increasing with citizen demand for timely and cost-effective services and so are the NIS risks for state and local administrations. The risk of public online services being hindered by NIS problems exists at all levels of government, local or regional.

Barriers & challenges

Private actors still lack effective incentives to provide reliable data on the existence or impact of NIS incidents, to embrace a risk management culture, to conduct serious risk management which involves the adoption of appropriate NIS measures and investment in security solutions. 31% of respondents (both business and consumers) to the public consultation affirmed to have no process in place to manage NIS risks. Also, 54.2% affirmed not to have any budget dedicated to NIS.

From an economic perspective security is an externality leading to market failure,[136] i.e. market players do not see the economic rationale of bearing the full social costs of increasing the level of security but rather prioritise time-to-market or low pricing for their end products. By leaving the decision on the level of security entirely to market players the societal benefits of a more secure digital environment would not be fully reached. Businesses fail to see the potential savings induced by NIS investments. Studies have indicated that by appointing a Chief Information Security Officer (CISO) businesses could save up to half of the cost of a data breach. The same considerations apply to public administrations which do not yet see the importance of investing in NIS to ensure the continuity and reliability of the public services they provide more and more online.

How to act?

1. Build on on-going EU policies on network and information security: a European Network and Information Security Agency (ENISA) was established in 2004. ENISA advises Member States on information security and in their dialogue with industry to address security-related problems. It collects and analyses data on security incidents in Europe and emerging risks. It promotes risk assessment and risk management methods to enhance

135 This area of activity can be an important element of a digital strategy. It might, however, not be eligible for funding through ESIF.

136 OECD (2008), Economics of Malware: Security Decisions, Incentives and Externalities.

capability to deal with information security threats. Finally, it is active in awareness-raising and co-operation between different actors in the information security field, notably by stimulating the cooperation between the public and private sectors and developing public-private partnerships with industry. ENISA's web site is the European 'hub' for exchange of information, best practices and knowledge in the field of Information Security.[137]

The revised regulatory framework for electronic communications,[138] in force since November 2009, requires providers of electronic communications to appropriately manage the risks to their networks and to report significant security breaches.[139] These obligations had to be transposed at national level by May 2011.

All players that are data controllers (for example banks or hospitals) are obliged by the data protection regulatory framework[140] to put in place security measures to protect personal data. Also, under the 2012 Commission proposal for a General Data Protection Regulation[141], data controllers would have to report breaches of personal data to the national supervisory authorities.

The Commission proposes imposing NIS risk management and reporting requirements on public administrations and key private players to stimulate the creation of a culture of risk management and improve the sharing of information between the private and public sectors. The public administrations concerned include regional and local authorities.

Another aspect that deserves attention is the safety of the Internet for different segments of the population. SI Net II,[142] for instance, is a project for the European coordination of the network of Safer Internet Centres. The specific objectives of this project are to ensure maximum co-operation and effectiveness of awareness-raising, hotlines and helplines actions across Europe and to provide logistical and infrastructural support for the Safer Internet Centres, ensuring European-level visibility, good communication and exchange of experience so that lessons learnt can be applied on an on-going basis.

2. Governance/stakeholder involvement: Public regional and local authorities should engage with relevant stakeholders. These actors should include:

- Public sector, such as national/regional ministries in charge of NIS, or regional and local governments; national or local CERTs and NIS authorities;
- Standardisation and certification bodies;
- Universities and research institutes;
- Professional and end user associations;
- Private sector: operators in specific critical sectors (banking, electricity, natural gas, transport, health), enablers of key Internet services, law firms, insurance companies. Public regional and local authorities should also make an assessment of their own needs in terms of increased NIS and in particular proceed with an audit.

3. Priority setting: NIS is important for very different sectors. In the order of estimated NIS revenues of main industries in 2010, the following consumers and main industries were major users of NIS: general services, manufacturing, public services, financial services and consumers. Business spending on NIS grew very strong in companies with more than 250 employees. The hardware market for NIS is very concentrated. All these aspects should be considered when choosing priorities within NIS markets.

4. Policy mix: In this process, regions should also seek synergies with other national and regional initiatives and EU activities. Of particular interest in this area could be: (a) the Horizon 2020 Framework Programme for Research and Innovation, to be launched in 2014. Horizon 2020 will support security research related to emerging ICT technologies; provide solutions for end-to-end secure ICT systems, services and applications; provide the incentives for the implementation and adoption of existing solutions; and address interoperability among network and information systems ; (b) Connecting Europe Facility (2014-2020), in particular regarding the deployment of Digital Service Infrastructures which aim at providing trans-European interoperable services of common interest for citizens, businesses and governments[143].

In February 2013, the Commission adopted a Communication on an EU Cybersecurity Strategy. The Strategy in particular contains actions to promote cyber security awareness at all levels. A cyber security championship should be organised in 2014, where university students will compete in proposing NIS solutions. A yearly cyber security month with the support of ENISA and the involvement of the private sector should be organised from 2013 onwards, with the goal of raising awareness among end users. Training on NIS should be introduced in schools as well as training on NIS and secure software development and personal data protection

137 http://www.enisa.europa.eu.

138 See http://ec.europa.eu/information_society/policy/ecomm/doc/library/regframeforec_dec2009.pdf.

139 Articles 13a and 13b of the Framework Directive.

140 Directive 2002/58 of 12 July 2002.

141 COM(2012) 11.

142 http://www.saferinternet.eu/web/insafe-inhope/home.

143 CEF Budget line 09.03.02 – Telecommunications networks (to promote the interconnection and interoperability of national public services on-line as well as access to such networks). https://ec.europa.eu/digital-agenda/en/connecting-europe-facility.

for computer science students by 2014. Finally, NIS basic training should be conducted for staff working in public administrations.

The Strategy is accompanied by a proposal for a Directive on Network and Information Security. The proposal requires in particular all the Member States to set up a well-functioning CERT, responsible for handling security incidents and risks, and appoint a national competent authority for NIS which would have a coordination role. Both would need to have adequate staff and financial resources to carry out their tasks effectively. Both CERTS and competent authorities could have regional or local branches, adopt a national NIS contingency/cooperation plan defining protocols for communication and cooperation among relevant players at national level in case of NIS incidents of a certain scale, and a national NIS strategy that would outline the strategic objectives and concrete policy actions to pursue a high level of NIS.

5. Monitoring and evaluation: Market maturity indicators are useful for monitoring the market context, IT security spending and business adoption of IT security. The study European Network and Information Security Market[144] offers a good overview of potential market indicators. Given that the NIS market is very dynamic and rapidly evolving, it is important to keep track of new developments.

Further reading

http://s3platform.jrc.ec.europa.eu/network-and-information-security

144 http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=2153.

6. ICT Up-Take

6.1 ICT innovation vouchers – SMEs getting digital

Why should regions invest in ICT innovation voucher schemes?

ICT Innovation Vouchers are implemented by EU regions to improve the competitiveness and stimulate growth of microenterprises and SME by developing new products, processes and businesses. In addition innovation vouchers can boost demand for a large range of innovative ICT-related services – notably e-commerce including cross-border online sales – and thus contribute to reaching the *Digital Agenda for Europe*'s priorities.

The digital revolution has not yet given its full potential for innovation and growth for microenterprises and SMEs. Promoting ICT uptake as an innovative business solution for SMEs is a key factor for success: software and intangibles - such as training in IT competencies - combined with adequate investment in hardware and high-speed connectivity is often essential to boost results and sustain the business of microenterprises and SMEs.

The analysis of existing voucher schemes across the EU - not necessarily ICT-related - confirms that it is a delivery mechanism that is particularly efficient for reaching out to micro-enterprises and SMEs in a streamlined manner.

Barriers and challenges

The ICT Innovation Vouchers Scheme represents a strategic tool for regional authorities within a larger offer of innovation support services for microenterprises and SMEs. ICT uptake and use is one of the most important drivers that enable start-ups and SMEs to achieve high growth and create jobs. Several studies provide supporting evidence, in particular for SMEs that establish an active presence on the web. It is also a way of improving cross-sector economic interactions and innovative solutions for SMEs in order to modernise and make local and regional economic landscape competitive.

ICT enables SMEs to increase competitiveness and reach global markets. A recent study[145] showed that 81% of the smaller commercial firms selling on the eBay platform export to at least five foreign countries. This would be impossible for a non-digitalised SME. The importance of using new ICT technologies for enhancing business or 'soft' processes for productivity increase and for raising growth of companies in general is well recognised.

However, European companies are making, on average, slow progress in adopting ICT.[146] This is especially true for SMEs compared to larger companies. The gap between SMEs and large enterprises is bigger when it comes to using more advanced ICT applications. Whereas broadband connectivity and having a website are becoming standard practice, e-commerce and the adoption of more sophisticated ICT tools for internal processes are less frequently used in SMEs.[147]

It should be noted there is no "one-size-fit-all" for innovation voucher schemes. Different modalities should be used according to the specific needs of the region such as ICT potential and intensity, the capacity to manage implementation, previous experience in supporting such measures or the need for improvement in ICT-uptake.

How to act?

Policy makers should start a process of analysing their particular situation, developing a vision, identifying competitive advantage, setting strategic priorities and making use of smart policies to maximise the knowledge-based development potential of any region, strong or weak, high-tech or low-tech. In this framework ICT innovation vouchers can be developed.

For the managing authority of a Member State or a region wishing to set up an ICT innovation vouchers scheme, the implementing process would then be the following:

145 eBay (2012), Towards Commerce 3.0, Ebay EU Liaison Office, March 2012, p. 9.

146 Eurostat (2013), Statistics in Focus: Enterprises Making Slow Progress in Adopting ICT for e-Business, ICT Usage in Enterprises 2012 (6/2013), p. 1.

147 Eurostat (2013), p. 2.

1. Define in the operational programme an ICT innovation vouchers scheme

Smart specialisation can entail that each region analyses its ICT needs and opportunities for their regional development and growth as well as for research and innovation. Among the types of actions to be supported and expected to be included in the related Operational Programmes, an ICT innovation vouchers scheme can be developed. The operational programme shall set out clear intervention logic behind the use of vouchers, similar to other types of foreseeable action.

The decision to use vouchers should be taken as part of a broader strategy to support ICT uptake and innovation in a regional economy. The impact of such a scheme will need to be assessed. An ICT innovation vouchers scheme should only be considered if it targets innovative solutions and does not subsidise trivial or non-sustainable activities. It has to fit real ICT needs and potentials of local entrepreneurs.

Experience shows that the introduction of a voucher scheme makes more sense if it is combined with other existing or new policies or instruments supporting ICT and/or entrepreneurship and/or innovation: for instance entrepreneurship mentoring, coaching, networking, etc.[148] Ways should be sought to integrate both aspects in a scheme.

2. Identify an implementing body for the ICT innovation vouchers scheme

The identification of the body that will implement a vouchers scheme is crucial. This task is often taken on by the local/regional business development or innovation agency. Its network and capacity is essential to translate and match demand for ICT solutions from SMEs with innovative solutions offered by ICT providers. The implementation body must be independent from the market service providers. In the context of the ESIF, this can be the managing authority of the respective programme or an intermediate body designated by the Member State to whom implementation tasks of the managing authority are delegated, such as banks, associations or a public private partnership.

Implementing body will focus on matching demand and offer of services – delivering added value in terms of determining the needs on the demand side – and checking customer satisfaction and quality of the service delivered.

Commitment of the relevant regional authorities through promotional support activities also helps greatly in publicising the scheme and boosting local ownership. According to the available amount of funding, the promotional strategy to make a vouchers scheme known usually includes PR campaigns, use of existing networks and institutions (e.g. chambers of commerce), websites and social networks, email campaigns and awareness raising events.

3. Tailor the ICT voucher scheme to the regional implementation

According to the capacities of the implementing body and the economic reality of the region, as well as the potential impact expected by the regional policy makers, the implementing body will develop and implement the process to obtain and redeem ICT vouchers. The implementing body will also foresee a monitoring mechanism in order to measure the performance of the scheme in the short-, medium- and longer-terms. Further details and guidelines on how an ICT innovation vouchers scheme could work are described below. Different perspectives are presented in order for regions to decide how they would like to further adapt a scheme to their reality or simply refine certain conditions in order to focus on a specific desired impact. The key goal – beyond any tailor-made solutions – is to keep the scheme '*fast and light*' for the applicants.

ICT innovation voucher pilot regions - ICT innovation vouchers are piloted in the Spanish regions of Extremadura and Murcia. SMEs in these regions will be one of the first in Europe to benefit from this opportunity which is due to roll out across Europe in 2014.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/innovation-voucher

148 Business advisory services can be delivered via voucher schemes, but these will normally amount to less than 10,000 EUR and require substantial own contributions from the recipient firms and vary substantially in their content and conditions, depending on the needs and potentials in the region. Such services have to be technology neutral, i.e. allow a cost-benefit comparison of different IT solutions. They should also be responsive to the needs of SMEs, i.e. provide advice in a wider business development perspective that might require changes in the business model, repositioning in the value-chain, training of staff in terms of innovation process management or entrepreneurial skills, transfer of technologies other than ICT, legal advice for cross-border e-commerce activities etc. Vouchers (or ordinary grants) cannot be used for merely subsidising the cost of subscription to a cloud computing service (these are running costs and are thus not eligible for ERDF support). The advisory services must not favour specific cloud computing service providers. If, for example, an SME project uses cloud computing services to increase its competitiveness, the costs for cloud subscriptions are eligible for ESIF as part of the overheads.

6.2 Web entrepreneurship to boost start-ups in Europe

Why invest in web entrepreneurships and start-ups?

Web entrepreneurs constitute a specific category of entrepreneurs who create new digital services and products that use the web as an indispensable component.[149] The businesses web entrepreneurs start do not only create many new jobs in the digital industry, but also have an important transformational and cross-border impact on the society and economy. Start-ups create the majority of new jobs and currently one third of new start-ups are web start-ups in Europe.[150] To ensure that Europe benefits fully from web entrepreneurship, it is desirable that more web entrepreneurs start up and stay in Europe.[151]

There are many new and quite specific entrepreneurial ecosystems emerging in Europe. Web entrepreneurs are part of them. However their skills and the challenges they will face are distinct from those facing start-up founders in other industries across Europe. Making use of ESIF to co-finance web entrepreneurs and web start-ups can help regions play a key role in growth.

Web entrepreneurs rely on existing web technologies, Application Programming Interfaces (APIs) and cloud platforms to develop new products and create new services, as well as to distribute and sell them. They operate in a complex and fast moving eco-system, where networking and experimenting is paramount. They often require relatively little time to build new web products and distribute them, which means the time between idea and go-to-market is shorter. The web being their main development tool, they can operate independently of physical locations, both in terms of building their businesses and finding and serving clients.

Web start-ups are cheaper to set-up and the entry barriers are low, making them an attractive vehicle to start an entrepreneurial career. On the other hand, they need to deal with high risk of failure, a global, borderless playing field and often unproven existing technologies, platforms and distribution mechanisms. Web start-ups tend to grow and fail faster than other businesses, which translates into higher rewards, but also higher risks.

French Start-up Barometer - 108 Tech Start-ups in France produced over EUR 1 billion in turnover during 2011, with 33% growth over the previous year, surpassing most French 'giants'. The 108 French start-ups also hired 24% more people than the previous year, with 87% of those jobs being permanent with CDI (Contrat à durée indéterminée) contracts.

Web start-ups often reinvent and reshape existing incumbent companies, market segments, or even entire industries. (e.g. Zappos for retail shoes, Spotify for music, Rovio for games and Cousera for education). The most successful web start-ups can grow from a team of 2 people to 200 people in less than a year, and increase revenues tenfold in the same period from customers worldwide. The impact of web businesses will further grow in the future, as they capitalise on a massive and global customer base and on powerful new functionalities (mobility, sensors, big data, social media, etc.).

Barriers & challenges

There is an unbalanced distribution of facilities and resources for web entrepreneurs across Europe, which creates a disadvantage for entrepreneurs in countries where there are fewer facilities and resources. The lack of entrepreneurial culture, risk awareness and access to resources are the main reasons why entrepreneurs decide to leave Europe and move to the US to establish their company.

Web entrepreneurs have limited access to venture capital, bank loans and public funding due to the way funding is obtained and to lack of information. Business angels are dealing with the lack of financing by providing opportunities for attractive start-ups in exchange for equity, which motivates both parties to achieve the best result possible.

The rigidity of workforce regulations, combined with discouraging tax regulations and the complexity of the regulations are other barriers that most entrepreneurs have to face in order to manage a start-up. Other countries, like the US, offer tax breaks and less constrained workforce legislation to benefit start-ups and to help them during the critical first years.

Europe is struggling to create new start-ups, make them grow and turn them into global leaders. This is true also for web start-ups, and with the attractiveness of Silicon Valley and other emerging markets it is very difficult to keep start-ups in Europe

How to act?

Since Web entrepreneurship covers several aspects of the EU jobs and growth agenda, it is important that Regions and National authorities consider the following actions. Regional and EU policy programmes and ESIF must tackle them in the short term period in order to foster innovation and entrepreneurial ecosystems across Europe. A number of

149 Communication on the Entrepreneurship 2020 Action Plan.

150 Data from the USA (Start-up America Partnership).

151 The new Digital Entrepreneurship Monitor provides a monitoring mechanism to examine key trends in digital entrepreneurship. Information is provided about statistics, initiatives to support digital entrepreneurs and reports on business opportunities and digital technologies. See http://ec.europa.eu/enterprise/dem.

potential actions to support web entrepreneurs are described here.

Venture Capital: The main point and action to take would be to raise awareness among venture capital investors about the web business opportunities and help them understand the specific characteristics of web-entrepreneurship, including sharing success stories and networking activities. Start-up Europe Investors[152] aims to gather venture capitalists and business angels related to the Web in order to help Web entrepreneurs.

Venture Capital Funds in Ireland[153] - Over €800m in funding is available in Ireland through networks of angel investors, seed and venture capital firms. A total of €645m is under management in EI-supported SVC funds.

Crowdfunding: one of the most promising solutions for restoring capital to entrepreneurs and SME is crowdfunding. Defined as the collective effort of individuals who network and pool their resources, crowdfunding supports efforts initiated by other people or organisations. Start-up Europe Crowdfunding is a set of actions providing support, visibility, transparency and interconnectivity among existing EU crowdfunding platforms, including those specialised in Web start-ups. In order to understand the magnitude of these actions, EUR 2.7 billion has been raised globally through crowdfunding and EUR 945 million in Europe.

Symbid[154] - Symbid provides the infrastructure for the complete online financing of ideas and companies. An equity-based stock market for (nascent) entrepreneurs and small business owners with a financing need for a start-up, which can add up to EUR 2.5 million.

MyMicroInvest[155] - MyMicroInvest is an equity based crowdfunding platform that enables individuals to invest from EU 100 alongside professionals in venture capital investment.

Accelerators: Accelerators provide a combination of services, including mentorship, funding, networking, training and/or office space. Most accelerator programs run for a few months and they often take equity in exchange for providing their services. Start-up Europe Accelerators Assembly takes actions to increase awareness of the existing accelerator programs and of their benefits, by sharing success stories and best practices, facilitating networking activities and eventually attracting more Web entrepreneurs to enter accelerator programs.

Start-up Bootcamp[156] - Start-up bootcamp is a mentorship driven program; these mentors drive the start-ups acceleration over the 3 month program - and often for months or years afterwards. The Start-up bootcamp founders team, together with their group of international mentors, can open the door to nearly every investor, customer or partner. Start-up bootcamp is now running in these cities: Berlin, Amsterdam, Dublin, Copenhagen, Haifa and London.

Web Talent: One way to support web entrepreneurs is through educational resources in a costless, open and online like Massive Open Online Courses (MOOCs) These are generally free, open to everyone and can help web entrepreneurs initiate, consolidate, professionalise and grow their web start-ups into successful businesses. In this context, the European Commission has launched a call for tenders to foster Web Talent in Europe by encouraging the use of Massive Open Online Courses focused on web skills and entrepreneurship.

iversity[157] **– Open university courses and education for everyone:** This platform provides interactive courses and make them accessible around the globe. This platform empowers the university and the academics that work there, by allowing the best professors to teach thousands of students and it allows students to take classes from the best professors around the globe. In doing so, iversity improves the quality of teaching at existing institutions, without raising the cost of instruction. Open courses can be an important factor in that equation.

Apps Economy: Eurapp[158] is an on-going study of the economy that surrounds "apps" or applications for mobile devices that will provide a comprehensive review of the size of the app economy in Europe. It will identify bottlenecks and provide recommendations of how to overcome these. Apps for Europe[159] - turning Data into Business will create a thematic network to organise competitions for using open data, stimulate the winners to start business ventures, and maximise the socio-economic impact and overall benefits of open data.

Events: hosting and arranging events can be a way of attracting skilled people, interesting examples include Europioneers, Tech All Stars, Le web[160] and The Next Web Conference.[161]

152 http://www.webinvestorsforum.eu.

153 https://www.enterprise-ireland.com/en/Invest-in-Emerging-Companies/Source-of-Private-Capital/Venture-Capital-Funds.html.

154 http://www.symbid.com.

155 http://www.mymicroinvest.com/en.

156 http://www.startupbootcamp.org.

157 https://www.iversity.org.

158 http://eurapp.eu.

159 http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=325090.

160 http://www.leweb.co.

161 http://thenextweb.com/conference/europe.

Coworking Spaces: Coworking spaces are an alternative way of working in which independent professionals and others with workplace flexibility share one working environment, rather than working remotely in separate offices or places. The main idea is that individual workers come together in a shared place to increase productivity, through a more creative environment and a sense of community. There are EC plans to support the linking of co-working spaces across Europe.

Betahaus[162] - Beta is a coworking space of 2000 sqm for events and professional jobs. There are wireless, fixed and flexible workstations, meeting rooms, a café and event space. In Betahaus around 200 professionals from various fields of work, including graphic designers, programmers , photographers, architects, designers, academics, lawyers, NGOs , translators, video artists, journalists and bloggers.

Further reading

http://s3platform.jrc.ec.europa.eu/web-entrepreneurship-and-start-ups

162 http://www.betahaus.de.

6.3 Digital skills to boost innovation

Why invest in digital skills?

ICTs are the single most important drivers of innovation and growth for national and regional economies across all sectors. More than 75% of the value added created by the Internet is in traditional industries. 55% of ICT practitioners work outside the ICT sector itself. In order to foster productivity in the private sector and public administration, the purchase of ICT equipment, software and broadband is not enough. Attaining the objective of enhanced use of ICT requires a combination that includes measures to improve digital skills.

In the EU as a whole, demand for ICT practitioners (i.e. people working mostly in ICT) is increasing by 100,000 to 150,000 jobs per year, but supply is not following. As a result, there is a shortage of ICT practitioners, estimated to reach up to 900,000 by 2015, despite large overall unemployment. Beyond that, digital skills are needed throughout the workforce. Most jobs nowadays already require some kind of computer related knowledge. The OECD estimated in 2009 that in the EU around 18.5% of employed persons are intensive ICT users in their work, ranging from 9% to 31% depending on the Member State. It has been forecast that, by 2015, 90% of jobs will need at least basic computer skills.

From a potential investor perspective, the availability of digital skills in a region is a key factor in deciding on the location of investment of any but the most basic industries.

Polishing IT skills[163] - Managing computer networks is a rapidly growing profession in Poland, where expert network administrators are much in demand. To help meet companies' requirements, the Kazimierz Wielki University is recruiting for courses starting in August and September. The training programme is free of charge to employees from SMEs and will lead to recognised industry qualifications. Courses are co-funded by the ESF and are open to residents of the Kuyavian-Pomeranian region. The project is running from 2010 until 2013.

Barriers & challenges

The demand for digital skills is much diversified, as is the initial knowledge of potential candidates. As a result, training needs to be highly targeted to be effective, leading to relatively high overheads compared to other funding requests. The need for additional ICT skills is most pronounced in SMEs, but due to the large variety of ICT skills needed SMEs might find it difficult to introduce this topic in the national/regional priority setting process. Given the excess demand for ICT practitioners in some countries, but not in others due to the current crisis, national and regional governments in the crisis countries are reluctant to use their EU funding to train people who they fear will then move away.

How to act?

Regions wishing to invest in digital skills should consider the following 4 steps:

1. Analysis: (a) Assess the levels of skills of ICT users among the labour force and ICT professionals, as well as ICT knowledge in the general population; (b) assess the quantity and quality of the ICT training provided; (c) assess the local demand for ICT workers; (d) estimate the cost of additional training.

2. Governance/stakeholder involvement: Public regional and local authorities should engage with relevant stakeholders. These actors will vary depending on the potential available in a region, but may include:

- public sector, ESIF management authorities, public employment services;
- SMEs and large companies;
- associations;
- training and education providers (schools, universities, vocational training providers) and players involved in training design (e.g. chambers of commerce).

WebActivate[164] enlisted the support of 400 SMEs to hire 200 trainees to set up Internet sites for them for free. This gave the trainees much-needed work experience and helped SMEs create a larger potential client base and develop online services. Within three months of the traineeship, 56% of the participants had found jobs. In addition, the programme has brought together a pool of former unemployed people, in the three cities where it was delivered, which has boosted social inclusion in the Galway region of Ireland.

PELIT[165] - The project created a demand-oriented training platform for the Schleswig-Holstein sector of information and communication technology and media. The content of the learning modules was agreed jointly to ensure that all project partners will benefit from this. Since the start of the project, more than 100 employees from the IT industry expanded their IT skills through this training tailored to their needs

3. Priority setting: The two examples below illustrate the scope within which different priorities can be chosen.

163 http://www.ciscoefs.ukw.edu.pl.

164 http://ec.europa.eu/esf/main.jsp?catId=46&langId=en&projectId=274.

165 http://ec.europa.eu/esf/main.jsp?catId=46&langId=en&projectId=447.

4. Policy mix: In this process, regions should also seek synergies with other national and regional initiatives and EU activities. Of particular interest in this area could be: (a) FP7/H2020 programmes, (b) Current CIP ICT Policy Support Programme; (c) Connecting Europe Facility (2014-2020), (d) Grand Coalition for Digital Jobs.

I can[166] - As employers in Bulgaria are often reluctant to train their staff, the National Employment Agency launched the 'I Can' project to motivate workers themselves to take more control of their careers and get involved in lifelong learning. To make applying for training as simple as possible, and thus encourage participation, the project introduced an innovative voucher system. Any employed person could apply and receive a voucher for key-competences training and/or a course leading to professional qualifications – according to their wishes and needs, including ICT skills. In the first two phases of the 'I Can' project, 140 000 employees took part, while in the follow-on 'I Can Do Better' project, a further 81 000 participants are expected by the end of 2013. EU funding amounted to EUR 60 million, and the project is running between 2009 and 2013.

5. Monitoring and evaluation: The following are suggestions for data to include in a monitoring and evaluation scheme:

- Share of ICT professionals in the labour force (Eurostat labour force survey)[167]
- Share of population with low/medium/high ICT skills (Digital Agenda Scoreboard)[168]
- Number of new enrolments in tertiary ICT education
- Number of graduates of tertiary ICT education (Eurostat)[169]

Further reading

http://s3platform.jrc.ec.europa.eu/digital-skills

166 http://ec.europa.eu/esf/main.jsp?catId=466&langId=en&featuresId=296&furtherFeatures=yes.

167 http://epp.eurostat.ec.europa.eu/portal/page/portal/employment_unemployment_lfs/methodology/definitions.

168 http://ec.europa.eu/digital-agenda/en/scoreboard.

169 http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=tps00188.

6.4 Living labs for regional innovation ecosystems

Why invest in promoting living labs?

Living labs are defined as user-centred, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings. In practice, living labs place the citizen at the centre of innovation, and have thus shown the ability to better mould the opportunities offered by new ICT to the specific needs and aspirations of local contexts, cultures, and creativity potentials.

The Green Paper on Research, Development and Innovation (RDI) policy reform recommended that all future programmes "should provide more [European] added value, increase [their] leverage effect on other public and private resources and be used more effectively to support the strategic alignment and pooling of national and regional funds, to avoid duplication and [fragmentation]". The flagship initiative Innovation Union invited Member States to overcome traditionally "compartmentalised approaches" between research and innovation financing, setting a narrower focus on the outcomes to be achieved by meeting the two ends of the RDI value chain, possibly in relation to grand societal challenges and to previously stated policy objectives. Thus, the rationale of EU sponsored public intervention in this domain merges the aspiration to push the technology frontier ahead to improve community life with the pragmatic requirement of translating RDI results into new products and services that meet market expectations and ultimately lead to the creation of "more and better jobs". Not only are these recommendations shaping the agenda of Regional Policy and Territorial Cooperation for 2014-2020, but also Horizon 2020 and the "smart specialisation" conditionality requirement now engaging all EU regions.

Citilab[167] is a centre for social and digital innovation in Cornellá de Llobregat, Barcelona. It is a mix between a training and research centre and an incubator for business and social initiatives. It sees itself as a centre for civic innovation, using the Internet as a way of innovating in a more collaborative manner, integrating citizens in the core process.

Laurea living labs[168] is hosted by an R&D oriented university of applied sciences in the Helsinki metropolitan area and focuses on service innovations. Through its several locations and its innovation process based on Learning by Developing, it acts both as a host organisation and as an innovation service provider focusing on welfare, knowledge intensive business services and social responsibility.

170 http://www.citilab.eu/en.

171 http://www.laurea.fi.

Benefits, barriers & challenges

Living labs can be an instrument to support the transformation of RDI policy in the direction of territorial development, assuming three possible configurations (which depend on the structure of the underlying innovation system):

- As vertical tools for promoting user-driven RDI in a given sector (e.g. eHealth, domotics, or eInclusion), thus attracting investments and talents (or simply tourists) into a region and contributing to the implementation of smart specialisation in the territory;
- As 'orchestration' agents between individual users and the other PPP stakeholders. Therefore, playing a "more encompassing and systemic role" in structuring and providing meaning to user engagement in RDI processes within the broader context of territorial innovation policy;
- As territorial innovation or "Smart Region" models, including guidelines for a proactive behaviour of public administration, grounded on a successful mixture of technological, social and organisational RDI activities, to valorise local intellectual capital and increase knowledge for development.

The key challenge for regions during the next programming period will be to identify and valorise their respective economic niches and competitive advantages in the perspective of smart specialisation. Living labs can be supportive of this process and have already been used as a means to identify regional innovation potentials and co-design meaningful local digital agendas by engaging not only the ICT industry and the digital innovation community, but also the citizens and businesses who will ultimately benefit from the new infrastructures and services as for example the CIP (ICT PSP) Connected Smart Cities projects, such as CitySDK[172] (a toolkit for the development of digital services within cities by utilising the expertise and know-how of developer communities) and Specifi[173] (facilitating the set-up, customisation, delivery and sharing of innovative, user co-designed arts, media and leisure services locally, regionally, and across Europe). The Creative Ring[174] initiative, as a new European experimental community and platform, initially involves five different living labs in three different regions[175] to develop the open collaboration between local creative communities, research, local authorities and ICT companies towards a connected network of cities and regions to boost creativity in Europe.

Recently, the CIP (ICT-PSP) project Parterre[176] successfully piloted eParticipatory methods and tools for spatial and

172 http://www.citysdk.eu.

173 http/www.specifi.eu/specifi.eu.

174 http://www.specifi.eu/about/the-creative-ring.

175 Catalonia, Flanders and Trentino.

176 http://www.parterre-project.eu.

strategic planning in territorial development at the level of six European regions. As a follow-up to the CEE CentraLab[177] project, the Budapest Manifesto has been launched, which aims at building a European network for social and territorial innovation with the goal of promoting citizen-centric participatory processes at the service of regional smart specialisation. In the Apulia region, ERDF funds are being used to promote high impact RDI carried out by ICT living labs that effectively respond to specific requirements previously stated by the potential beneficiaries (belonging to public administration and the third sector) who are directly involved in the project partnerships with the task of managing the pilot phase. This corresponds to the logic proposed by the so-called challenge mechanism set forth within the CIP (ICT-PSP) Connected Smart Cities project Periphèria.[178]

Implementation models and issues

The box below provides some examples of living lab initiatives already funded through the ERDF. These projects show the richness of methods and approaches for applying the Living Lab approach. They all have in common a user-centric co-design process for development and implementation of innovative ICT-based products and services. However, living labs can be very diverse in structure and focus, ranging from science parks adopting user-driven approaches to LEADER LAGs integrating co-designed ICT platforms into their local development schemes. The governance model adopted is based on citizen engagement and generally follows the scheme of public-private-people partnerships (PPPPs) or the quadruple helix scheme, which opens up innovation systems to new actors such as cities and regions with chief innovation officers, local SMEs selling in global markets, social innovators and entrepreneurs, digital artists, and a myriad of urban innovative communities.

Table: Project examples of EU-supported living labs

SF in the TC framework (various programmes)	LILAN (Baltic LL programme)[176] Interreg 4A BALLAD[177] CEE Centralab[178]	MED Medlab[179] Alcotra Innovation SP[180] SEE ClusterPoliSEE[181]
SF at regional level (mostly ERDF/EARDF)	PACAlabs[182] Apulian ICT Living Labs[183] OuluLabs (Patio)[184]	Trentino as a Lab[185] PCP experiments in VDA, IT[186] Living Lab for Well-being Technologies and Services (Western Finland)[187]
	Direct funding of regional RDI projects	Policy learning at regional level

177 http://www.centralivinglab.eu.

178 http://www.peripheria.eu.

179 http://www.lilan.org.

180 http://www.ballad-livinglabs.eu.

181 http://www.centralivinglab.eu.

182 http://www.medlivinglab.eu.

183 http://www.alcotra-innovation.eu.

184 http://www.clusterpolisee.eu.

185 http://emergences-numeriques.regionpaca.fr/innovation-et-economie-numeriques/paca-labs.html.

186 http://www.livinglabs.regione.puglia.it.

187 http://www.patiolla.fi/en/info.

188 http://www.taslab.eu.

189 http://emergences-numeriques.regionpaca.fr/innovation-et-economie-numeriques/paca-labs.html.

190 http://www.prizz.fi/sivu.aspx?taso=3&id=1167.

Innovative approaches to the formative evaluation of on-going activities and shared policy learning should be designed and implemented at MS and regional level. Incidentally, one of the six steps of the RIS3 guidelines is the integration of monitoring and evaluation mechanisms. The two projects mentioned above, CentraLab and Periphèria, have experimented outcome-based and participatory co-designed assessment criteria and indicators at regional and city community level, respectively. This approach can provide for evaluation approaches that really address local and citizen concerns while still being able to map onto the kind of indicators used in the Innovation Union Scoreboard. In addition, the above-mentioned BALLAD initiative has analysed the partner regions ICT-related living lab structures, work, processes and methods including their ecosystems and gathered good practice cases from each of them. Moreover, other EU-funded initiatives (such as the Cliq-project,[191] INTERREG) have underscored the important relationship between local innovation and living labs. Their successful implementation grounds on the strong network of relationships established and consolidated by the local living lab's PPPPs.

Finally, living labs allow a bottom-up policy coherence to be reached, starting from the needs and aspirations of local and regional stakeholders, creating a bridge between Horizon 2020, regional smart specialisation, the urban agenda, the EARDF, and so forth. In this context, living labs can be somehow thought of as a transversal, ICT driven, 'lead market' meeting the requests of the Council and the EP for "strengthening synergy between EU support policies in the area of research and innovation" and placing regions and cities as leading actors in Europe's innovation strategies.

Some of the instruments through which living lab strategies can be enacted include:

Support for the inclusion of living lab methods and tools within the design of 'shared' regional Smart Specialisation Strategies, in particular as regards digital social innovation, promoting specific partnerships and initiatives as a measure of conditionality.

Coordination of RDI initiatives funded by Horizon 2020 with ERDF-supported local development schemes acting as pilots, also in the framework of Territorial Cooperation and under specific ERDF provisions for Integrated Territorial Investment, Community-led Local Development (including support under the EAFRD), and Inter-regional Cooperation, as well as planned instruments and initiatives such as the "Innovative actions in sustainable urban development", through, for example, a favoured status for Horizon 2020 proposals coupled with pilot initiatives co-funded by ESIF.

Adoption of pre-commercial procurement as a transversal instrument for the promotion of regional RDI, linking cooperative EU-level research (e.g. binding with Horizon 2020 objectives) with the societal challenges raised by national and regional policies.

Regions wishing to invest in the living lab approach can count on the support of ENoLL, the European Network of living labs.[192] Constituted with the Helsinki Manifesto and supported by the European Commission through a sequence of support actions particularly focusing on SMEs, ENoLL now counts several members in all but two EU Member States as well as 5 continents in addition to Europe. ENoLL is well placed to act as a platform for best practice exchange and a common repository of economically viable and socially accepted solutions. These different living labs provide test and experimentation facilities targeting innovation in many different domains such as energy, media, mobility, healthcare, agrifood etc. Under the auspices of ENoLL and the ERDF-funded projects mentioned above, other regional and national networks have also been established.

Further reading

http://s3platform.jrc.ec.europa.eu/living-labs

191 http://www.cliqproject.eu/en.

192 http://www.openlivinglabs.eu.

6.5 ICT in education: digital schools and classrooms

Why should regions invest in ICT infrastructure and connectivity in schools?

The Internet has dramatically changed the lives of citizens in many different aspects; however EU Education is failing to keep pace with the digital society and economy. The potential that digital technologies can offer EU education and training systems across Europe remains untapped.

At present 63% of 9-year olds in Europe are without access to digital equipment, fast broadband and high connectivity in schools; teachers acknowledge that they would like to use the technology in teaching, but 65% lack the necessary confidence and say they want training.

Transforming education requires pedagogical, organisational and technological innovation, and one of the basic conditions for enabling learning practices to flourish is the availability of ICT equipment, tools and networks. Learning takes place in learning environments which are increasingly open and flexible, embedding a diversity of learning and teaching practices and responding to the personalised needs of each learner. The level of ICT equipment and adequate broadband capacity - connectivity - in schools in the EU is often poor. There is an urgent need to step from an early adoption of ICT use in education towards its mainstreaming across all classrooms in Europe.

A wider use and uptake of digital technologies in teaching and learning can also enable and facilitate Europeans to acquire the basic level of digital skills needed for finding jobs. At present these skills are not being fostered or developed thoroughly. For example by 2015, 90% of jobs will require at least a basic level of digital skills, while as of today only 50% of Europeans have these.

Barriers and challenges

Though there are many examples of grass root initiatives at national, regional and or local level, these suffer from lack of sustainability and scale. Moreover, the collaboration between practitioners and decision makers, required to achieve the necessary critical mass, is frequently limited.

Different types of bottlenecks - at different levels and affecting different stakeholders - hamper the digital education value chain. There is uneven availability of ICT, including connectivity, across Member States. Teachers lack the digital skills to innovate their teaching through digital technologies. There are persistent organisational barriers to supporting innovative and personalised learning and teaching as well as assessment practices. The legal and operational frameworks (e.g. curricula, assessment, funding) are often too restrictive and leave teachers insufficient space for innovation and creativity. There is a lack of quality digital contents across languages and subjects.

The digital learning infrastructure includes mobile devices, e-learning technology platforms, digital educational content, multimedia solutions, as well as broadband network of adequate performance and reach (including abundant wireless coverage in and out of school buildings. Any upgrading of the digital learning infrastructure must be also be accompanied by adequate measures in terms of teacher training (to ensure that teachers are digitally confident to teach through technologies effectively) and local leadership for the removal of organisational barriers for innovative pedagogical practices.

How to act?

In September 2013, the Commission launched the 'Opening up Education'[193] initiative to boost innovation and digital skills in schools and universities. This joint initiative, led by two Commissioners (Neelie Kroes, Commission Vice-President responsible for the Digital Agenda and Androulla Vassiliou, Commissioner for Education and Culture) focuses on three main areas:

- Creating opportunities for organisations, teachers and learners to innovate;
- Increased use of Open Educational Resources (OER), ensuring that educational materials produced with public funding are available to all;
- Better ICT infrastructure and connectivity in schools.

This initiative also ties in with the Grand Coalition for Digital Jobs,[194] a multi-stakeholder platform tackling the lack of ICT skills and up to 900,000 unfilled ICT-related vacancies.

Regions wishing to invest in order to support and contribute to the activities in their country should consider the following steps:

1. Analysis: Assess the kind of ICT Infrastructure and classroom connectivity development needed in the regions, and the educational level (e.g. primary, secondary, vocational training) and how actors at regional level could contribute to promoting an upgrade of digital infrastructures in education and training institutions, including broadband. Investigate the potential sources of complementary public (e.g. local and or at school level) and private financing.

193 http://ec.europa.eu/education/news/doc/openingcom_en.pdf.

194 http://ec.europa.eu/digital-agenda/en/grand-coalition-digital-jobs-0.

2. Stakeholder involvement: Public regional and local authorities should engage with relevant stakeholders. The stakeholders will vary depending on the specific situation in the MS and in the region, but should include:

- Public authorities who are increasingly aware of the potential of technologies to innovate in learning and teaching the importance of digital literacy in curricula and learning outcomes;
- Education and training institutions themselves;
- Learners (e.g. primary and secondary students, students with special needs, vocational training students, etc.);
- Teachers and trainers having to adapt and develop their traditional teaching practices;
- Private sector; including ICT industry and SMEs, and Education technology providers (publishers, content providers, device manufactures interactive whiteboards manufacturers, etc.).

3. Priority setting: Establish clear roadmaps/strategic plans to reach the desired goals, in line with EU initiatives like Opening up Education.

4. Policy mix: In this process, regions should also seek synergies with other national and regional initiatives (e.g. from an educational and innovation policies perspective) and EU activities. The main responsibilities for designing, developing and implementing reforms in education and training systems remain with Member States. The EU will support and coordinate actions funded by Erasmus+ and Horizon 2020 programmes.

5. European networking: Not all Member States and regions are investing with equal speed and scale in the integration of ICT in mainstreaming education and training. National initiatives are often fragmented, isolated and result in large uptake gaps.

This means that cooperation at European level is paramount. There needs to be a strategy for how regional activities will align with national priorities to ensure that there is a coordinated national approach which will feed into achieving the objectives of the “Opening Up education” initiative.

Further reading & forthcoming events

http://s3platform.jrc.ec.europa.eu/education

6.6 Creating a safer Internet for children[195]

Why invest in safer Internet for children?

The internet is the natural playground and place of encounter, learning and creativity for the youth of today. However, children are going online younger and younger in an environment not specifically designed for them, either in terms of easily accessible content and services or in terms of adequate protection and support measures when they encounter risks. They use an increasingly diverse range of interconnected and mobile devices – they can go online, anytime, anywhere and to any site, often without adult supervision.

The internet is also one of the main distribution channels for material (images, films etc.) depicting sexual abuse of children. The content is becoming worse: 53% of the content reported to the hotline in the UK in 2012 depicts the rape or torture of a child and 81% of the victims are under the age of 10.[196] The overall challenge is to improve the quality of experience and content for children, appropriate to their ages, to provide tools and services to protect children online according to their age, and to prevent online exploitation of children through child pornography, grooming etc. Making use of the ESIF to co-finance activities aimed at creating a better internet for children and young people would help regions to become active players in contributing to EU objectives on promoting a safer use of the internet and in supporting the removal of online child sexual abuse content.

Barriers & challenges

There are bottlenecks in the online environment that children face today: the services through which children can come across harmful content, conduct and contact are increasingly international and an infrastructure is needed to route them (and their parents, carers, teachers as appropriate) to support and complaint services that operate on a national or regional basis. Reporting and sharing information on sexual child abuse images and sites is not yet developed and comprehensive at an EU–wide level both in terms of support organisations for taking down such content and concerning law enforcement in combating it. And the resources to support children, parents, carers and teachers to acquire the awareness and learn how to manage the online environment – for positive experiences and for risks – are fragmented and not readily accessible. The EU-funded project EU Kids Online has gathered evidence on children's experiences of online risk in 25 European countries. The aim of the project was to enhance knowledge of European children's and parents' experiences and practices regarding risky and safer use of the internet and new online technologies in order to promote a safer online environment for children.

EU Kids Online II: Enhancing Knowledge Regarding European Children's Use, Risk and Safety Online. Adopting an approach which is child-centred, comparative, critical and contextual, EU Kids Online II has designed and conducted a major quantitative survey of 9-16 year olds experiences of online risks in 25 European countries. The findings were systematically compared to the perceptions and practices of their parents, and they were disseminated through a series of reports and presentations during 2010-12.

How to act?

In 2012, the European Commission launched the European strategy for a better internet for children with the following priorities:

- Stimulate the production and promotion of quality content for children;
- Step up awareness and empowerment of children and parents by pooling resources;
- Create a safe environment for children by providing tools for parental controls, age verification and content classification;
- Fight against child sexual abuse online by providing interoperable tools for law enforcement/Industry/hotline cooperation in this field.

Under the framework of the Safer Internet Programme (which expires in 2013/2014), the EC supports a European network of Safer Internet Centres (SICs) present in all Member States, which has an important role for implementing the strategy. The network coordinates activities and brings together stakeholders to act and help transfer knowledge locally, regionally and throughout Europe. Under the coordination of Insafe and INHOPE, SICs work together to deliver a safer internet, ensure responsible use of the internet and mobile devices by children, young people and their families, and identify and remove illegal content online. Through this network of SICs – comprising awareness centres, helplines and hotlines – children and young people, and their parents and teachers can access information, advice, support and resources, or indeed report any illegal content they encounter online.

195 This area of activity can be an important element of a digital strategy. It might, however, not be eligible for funding through ESIF.

196 https://www.iwf.org.uk/assets/media/annual-reports/FINAL%20web-friendly%20IWF%202012%20Annual %20and%20Charity%20Report.pdf.

SI Net II is a project for the European coordination of the network of Safer Internet Centres. The specific objectives of this project are to ensure maximum co-operation and effectiveness of awareness-raising, hotlines and helplines actions across Europe and to provide logistical and infrastructural support for the Safer Internet Centres, ensuring European-level visibility, good communication and exchange of experiences so that lessons learnt can be applied on an on-going basis.

Regions wishing to invest in order to support and contribute to the activities carried out by the SIC in their country should consider the following steps:

1. Analysis: Assess the kind of activities and the regions covered by the SIC and in which way actors at regional level could contribute to reaching a bigger audience. Investigate the potential sources of public and private financing, including through Public-Private Partnerships (PPPs).

2. Stakeholder involvement: Public regional and local authorities should engage with relevant stakeholders. The stakeholders will vary depending on the specific situation in the MS and in the region, but may include:

- public sector; media councils, schools (awareness raising/ education), law enforcement bodies (fight against child sexual abuse images);
- universities (gathering research and evidence available on children online for knowledge sharing);
- children's welfare NGOs (awareness raising, running services like hotlines and helplines);
- private sector and companies (providing technologies and quality content for children).

Besides ESIF to co-fund safer internet activities as part of projects having an impact on the regional and national economy, MS and regions should consider PPPs to create new ways of funding. Stakeholders may therefore also include companies willing to invest in creating a better internet for children.

3. Priority setting: Discuss and agree on the level of ambition with the SIC which is coordinating the current activities in your country. Establish a roadmap to reach the defined goals. Further details and national contact points are listed on the Safer Internet Programme website. [197]

4. Policy mix: In this process, regions should also seek synergies with other national and regional initiatives and EU activities. The Safer Internet Programme, which is currently supporting the coordination of the network of Safer Internet Centres and the activities at national level, and the Connecting Europe Facility (2014-2020), in particular regarding the deployment of Digital Service Infrastructures which aim at providing trans-European interoperable services of common interest for citizens, businesses and governments. The issues related to the creation of a better internet for children are global and need regional, national, European and international solutions. As internet access and mobile phone use become more widespread in Europe and in the rest of the world, children are increasingly becoming active users of the technology. Material depicting child sexual abuse may be produced in one country, hosted in a second and downloaded all over the world. This means that cooperation at European level (and at international level for fighting illegal content online) is important and there needs to be a strategy for how regional activities will align with national priorities to ensure that there is a coordinated national approach which will facilitate the development of European strategies.

Further reading

http://s3platform.jrc.ec.europa.eu/safer-for-children

197 http://www.saferinternet.eu/web/insafe-inhope/home.

6.7 Music rights management infrastructures[198]

Why invest in the development of music rights management infrastructures?

In order to develop digital content services it is necessary to clear the rights of the content to be distributed. This can be a very cumbersome task. Digital technologies offer new opportunities for an efficient exchange of information concerning right owners, the required rights, licensees as well as the relevant uses.

A common music rights management infrastructure could help to identify which entity – whether a music publisher, a collection society or other institution – is in the position to allow for the successful granting of the requisite licenses for the exploitation of a specific song. For online platforms, it would be easier to reconcile royalty invoices. For the collecting society, it would be easier to identify the requested work in its repertoire or to determine which other society owns it. A common infrastructure would reduce time spent resolving disputes between users and licensors as well as amongst licensors arising from data discrepancies.

The development of an infrastructure for the management of music copyrights would be largely in the competence of the Member States. However, it would both benefit Member States and regions on several levels: national and regional creative content would be more easily accessible since both identification costs and transactional costs would be reduced. The competitiveness of national and regional creative industries would be improved. Although cross-border demand for national and regional creative content may be limited, international platforms for music and films often include national and regional content in their offers in order to make them more attractive to national and regional audiences. Also, it should be noted that one in five EU citizens is interested in receiving content from other EU countries when at home.[199]

Barriers & challenges

In the area of music rights management infrastructures, a challenge would be to take into account and adapt to existing initiatives. The most prominent initiative is the Global Repertoire Database, an industry consortium created further to the 2008 Online Commerce Roundtable launched by Vice President Neelie Kroes. It includes authors and composers, music publishers, and service operators (Google, iTunes, Omnifone). Collecting societies are represented through associations, however only a few European collecting societies are direct members.[200]

The objective of the Global Repertoire Database is to improve the information exchange between collecting societies, users and publishers through the systematic use of information exchange standards. A better information exchange would help to identify the exploited repertoire, collecting royalties and ultimately processing and distributing royalties.

A comprehensive exchange of licensing information and wide standardisation will only be possible if *all* actors, including collecting societies from *all* regions are able to connect to other collecting societies and online platforms.[201] Certain collecting societies have started creating hubs sharing a common backend IT system, e.g. PRS (UK) and STIM (SE).[202] Creating similar cooperation could notably be implemented by transregional programmes. On a national level, the UK initiative creating the Digital Copyright Hub following the 2011 Hargreaves-Report is a good example which proposes different measures to create growth and jobs by reforming the copyright framework.[203]

How to act?

Regions wishing to invest in the digitisation of cultural heritage should consider the following 5 steps:

1. Analysis: Assess the costs and potential gains of adapting to global copyright standards for your regional or national music industry.

2. Governance/stakeholder involvement: Public regional and local authorities should engage with relevant stakeholders. These actors will vary depending on the potential available in a region, but may include:

- public sector, such as national/regional ministries in charge of ICT, culture, or regional and local governments;
- collecting societies as licensors of content;
- technology firms – as providers of standardisation and database management technologies;

198 This area of activity can be an important element of a digital strategy. It might, however, not be eligible for funding through ESIF.

199 "Building the Digital Single Market – Cross border Demand for Content Services", Special Eurobarometer 366.

200 PRS (UK), SACEM (F), GEMA (D), BUMA/STEMRA (NL), SABAM (BE), SGAE (ES), SIAE (IT), STIM (SE).

201 Standardisation and simpler exchange of information is in line with the current legislative process on a directive on collective management and multi-territorial licensing is to be taken into account (Brussels, 11.7.2012, COM(2012) 372 final, 2012/0180 (COD)). The directive aims at enhancing the efficiency and good governance of collective societies as well as the multi-territorial licensing of authors' music rights online. The proposal for the directive refers to industry standards such as metadata for musical works as well as to voluntary industry initiatives which facilitate the exchange of licensing information.

202 Joint venture of PRS and STIM: http://www.prsformusic.com/creators/helpcentre/Pages/WhatisICE.aspx

203 Copyright Hub: http://www.copyrighthub.co.uk; Hargreaves-Process: http://www.ipo.gov.uk/hargreaves-copyright-dce.

- Internet actors –such as online content platforms, online platforms, broadcasters as potential licensees of content;

- authors' and composers' associations and trade unions – as members of collecting societies.

- Music publisher's associations – as members of collecting societies

3. Policy mix: Under the Competitiveness and Innovation Programme, the European Commission is funding/planning to fund innovation projects which aim at contributing to a music rights management infrastructure:

- FORWARD aims at a comprehensive, effective approach to the complex issue of audiovisual works rights assessment and Orphan Works.

- Arrow Plus builds on and further implements the Arrow system, developed within the Arrow project (eContent Plus Programme). Arrow is a system to facilitate libraries and other users in their diligent search for right holders in works that are to be included in a digitisation programme of books, by querying a network of European data sources.

- Rights Data Integration (RDI) is an exemplary implementation of a framework being developed by the Linked Content Coalition (LCC) to demonstrate how participants in the content supply chain can manage and trade rights for any and all types of usage across any and all types of content (physical, digital or abstract) in any and all media under any (or no) commercial model, and to support the provision of information to Users, some of which lead to the securing of licenses, some of which may be automated.

Furthermore, Member States and Regions should look for synergies with the Connecting Europe Facility (2014-2020), in particular regarding the deployment of Digital Service Infrastructures which aim at providing trans-European interoperable services of common interest for citizens, businesses and governments.

4. Monitoring and evaluation: Possible criteria and indicators are:

- Number of online platforms distributing creative content in the relevant Member State or region: The better accessible the national and regional repertoires are, the easier it would be for online platforms to enter the relevant markets (see industry initiative Pro Music[204]);

- Amount of royalties collected per Member State/Region: In 2010, almost 93% of the € 4.6 billion royalties collected in Europe were collected in Western Europe and the rest in Eastern Europe (Source: CISAC (2012) Global Economic Survey 2010);

- Administrative costs of collecting societies (see overview in the Impact Assessment of the proposal for a directive on collective management of copyright and related rights and multi-territorial licensing off rights in musical works for online uses in the internal market {COM(2012) 372 final}, p. 85).

Further reading

http://s3platform.jrc.ec.europa.eu/copyright

204 http://www.pro-music.org/legal-music-services-europe.php.

6.8 Pre-commercial procurement & public procurement of innovative solutions[205]

What is pre-commercial procurement and public procurement of innovative solutions?

The public sector in the EU, as elsewhere in the world, is faced with important challenges. These include modernising internal operations of public services to make them run more efficiently, as well as improving the external quality of public services to the citizens: improving high quality affordable health care to cope with an ageing population, the fight against climate change, improving energy efficiency, ensuring higher quality and better access to education, etc.

Addressing such challenges can require new and better solutions. When looking for such innovative solutions, typically procurers find themselves in one of two situations:

- In some cases, the required improvements can be addressed by solutions that are already or nearly on the market and don't require any new R&D. Solutions have typically been tested on a small scale but what is lacking are early adopters, committed to procuring a critical mass of end-products, to creating the incentive for industry to scale up its production chain and make some final products adaptations to meet the end-users' price / quality requirements for large scale deployment. This is when Public Procurement of Innovative solutions (PPI) can be used effectively.

- In other cases, the required improvements are so technologically demanding that there are no near-to-the-market solutions yet, and new R&D is still needed to prove that the market can really deliver commercially stable solutions with the desired price / quality requirements before procurers can commit to buy large volumes of end-solutions. Typically in such a case there are different potential suppliers proposing alternative competing solution approaches, but there is no conclusive test evidence yet as to which of the approaches will finally deliver the best value for money solution. This is when Pre-Commercial Procurement (PCP) can be used effectively.

Why should MS and regions use PCPs and PPIs?

By increasing "local" public sector demand to develop innovative solutions for the societal challenges of the future, PCP can help combat delocalisation and encourage companies to invest in highly qualified R&D in Europe. By triggering the development of breakthrough solutions ahead of the rest of the market, public authorities can, through their role of demanding first buyer, create opportunities for companies in Europe to take international leadership in new markets.

Compared to R&D subsidy programmes pre-commercial procurement enables an earlier reality check of industry R&D against concrete public purchasing needs, which can help to maximise the effectiveness of the R&D process and optimise public R&D spending. In that way, "local" industry R&D efforts can also be expected to produce fit-for-purpose products and the percentage of successful commercialisation of results coming out of "local/regional" government financed R&D projects can be expected to increase.

Pre-commercial procurement can attract foreign investors (e.g. venture capitalists) looking for promising opportunities to invest in companies involved in new emerging areas of innovation. By engaging actively as first potential customers in getting new solutions developed and tested, public authorities involved in PCPs can act as a "seal of approval" confirming the market potential of new emerging technological developments, thereby attracting new investors.

PCP and PPI are separate but complementary procurements. US evidence shows that this split PCP-PPI approach delivers significantly higher quality and on average 20% cheaper products compared to long term partnership R&D and deployment contracts that are prone to vendor lock-in. Focusing PCP on 'development' and PPI on 'deployment' also enables the use of PPI for closer to the market cases where no R&D is required to address the procurement need or R&D has already finished. A split between PCP and PPI thus allows companies that have developed products through means other than a PCP (e.g. through SME instruments, other grants, own company R&D resources) to still compete for PPI deployment contracts, avoiding issues of foreclosing of competition and crowding out of other R&D financing sources.

How to act?

For the Member State or region wishing to prepare their operational programmes in order to include PCPs and PPIs, the implementing process could then be the following:

1. Analysis: Everything starts with the identification and description of the selected thematic objectives and corresponding investment priorities and justification of their choice with regard to the innovative investment needs that are referred to in the operational programme. PCP and PPI could be identified and used for specific prioritised areas or they could act horizontally affecting all priority axes and investment priorities.

205 This area of activity can be an important element of a digital strategy. It might, however, not be eligible for funding through ESIF.

2. Awareness raising – promotion: It is essential that Member States or regions during the info days organised in the framework of the calls for proposals, and on other relevant occasions, inform potential applicants and the final beneficiaries about the available opportunities to achieve better and more innovative results for the public sector through the use of PPP and PPI.

3. Identification of the projects suitable for PCP or PPI: Focusing PCP on development and PPI on deployment also enables the use of PPI closer to the market cases, where no R&D is required to address the procurement need (e.g. organisational, design type of innovation), or R&D has already finished. In that sense it is important to first identify those projects / investments – or parts of them – for which solutions are already so close-to-the market that commercial end-solutions could be procured right away via PPI. Secondly, separate out those projects / investments – or parts of the above same projects / investments - that require new and better solutions not yet close-to-the market for which the R&D could be performed via PCP.

Consultation with key players in the region or in the eligible area of the programme would enable the managing authority or the region to analyse the big upcoming investment projects and to identify the parts which require innovations that are so new that they still require technology de-risking (development, and comparison and testing of alternative solution approaches from different vendors), suitable in that case for PCP.

4. Implementation of PCP and PPI in compliance with the legal framework: The 2007 PCP Communication and associated Staff Working Paper clarify that PCP falls outside of the WTO government procurement rules and outside the EU public procurement directives (article 16f of directive 2004/18 EC, article 24e of directive 2004/17 EC, and article 13 (f) (j) of directive 2009/81 EC) and is therefore also not subject to the remedies directive. However, in order to procure the R&D services in the PCP at market conditions without involving state Aid, the EU Treaty principles and competition rules must be respected in the implementation of PCPs. As with all other public procurements, PCPs must thus be implemented through transparent, competitive and non-discriminatory procedures. The exemption of PCP from the directives thus does not allow regions any more than in public procurement procedures that are subject to the public procurement directives, to favour local or SME suppliers over others or to require tenderers to locate R&D or make other types of investments in the region. Attention should also be given to the particular approach of distribution of IPR rights between procurer and suppliers in PCP, which is of key importance for exemption from the public procurement directives to apply to PCP.

In PPI, a buyers group uses the tactic of early announcement of the intention to deploy innovative solutions to encourage the market to make changes to their production chain to deliver solutions with the higher than available functionality and performance within a specified time frame. PPI uses classical public procurement procedures offered by the public procurement directives to buy goods and services on the commercial market. PPI is sometimes known under different local brand names in different EU countries, such as Technology Procurement in the US and Nordic countries and Forward Commitment Procurement in the UK. National legislation related to the PCP and PPI procedures, whenever existing is of course applicable.

Examples PCP and PPI projects:

- **CHARM** in the field of traffic management.[206]
- **SILVER** in the field of robotics solutions for elderly care.[207]
- An EU funded cross-border PPI project is the **LCB** healthcare project.[208]

Further reading & Events

http://s3platform.jrc.ec.europa.eu/digital-innovation-procurement

206 http://www.rws.nl/en/about_us/business_ opportunities/charm_pcp/index.aspx.

207 http://www.silverpcp.eu

208 http://lowcarbon-healthcare.eu

Appendix 1: Assessment grid

1. In what kind of document is the policy framework for the Digital Agenda for Europe (DAE) presented?

1.1 Is the policy framework part of the country's/region's overall research and innovation strategy (RIS3) or is it established in a separate document (e.g. national or regional "digital agenda")?

1.2 If the DAE policy framework is presented in a separate document, how does it relate to the overall research and innovation strategy of the country/region?

2. Is the DAE policy framework evidence-based?

2.1 To what extent does the DAE policy framework include/build on a sound analysis of the country's/region's existing situation with regard to scientific/technological and economic specialisations in information and communication technologies (ICT) or refer to such an analysis/related studies?

2.2 To what extent is it based on a sound assessment of the competitive ICT assets of the region, including an analysis of its strengths, weaknesses, opportunities and threats/bottlenecks (SWOT) taking into account key indicators of the Digital Agenda for Europe (DAE) Scoreboard?[209]

2.3 Does the DAE policy framework include an analysis of balancing support for demand and supply of ICT? More specifically, please state if the analysis covers all the relevant socio-economic issues (such as age structure, education, income, level of ICT training/skills, employment status, affordability of service, productivity, etc.) which characterise the local and regional context to establish the right balance between support for demand (to improve Internet penetration and the use of ICT services and applications in households, businesses and public administrations, increase eskills, etc.) and supply measures (availability of equipment, infrastructures, services and applications, and of ICT professionals/practitioners). Please list all demand and supply measures.

2.4 Besides a SWOT analysis, what other quantitative and qualitative information/methods have informed the DAE policy framework (e.g. cluster analysis, value chain analysis, peer review, foresight)? Please list methods used.

2.5 Does the DAE policy framework include an assessment of needs and available resources based on an economic analysis taking account of existing private and public infrastructures and planned investments for broadband?[210]

2.6 Does the DAE policy framework take into account the competitive position of the country/region and the potential areas of specialisation with regard to other countries/regions in the EU and beyond, as well as its position within global value chains?

2.7 Are sufficient efforts being made in the analysis to avoid imitation, duplication and fragmentation in identifying regional specialisations, in particular with regard to what is happening in neighbouring regions?

3. Is the DAE policy framework based on appropriate stakeholder involvement?

3.1 Has the DAE policy framework been developed through a wide process of direct stakeholder involvement, including mainly regional government/regional agencies, ICT companies, research institutes, universities but also other/new stakeholders with the potential for innovative contributions (relevant citizen and consumer groups as well as business associations, and the national regulatory agencies for telecommunications), through measures such as surveys, consultations, dedicated working groups, workshops, etc.? Please list which stakeholders have been involved and how this was done.

209 The European Commission has adopted the DAE as part of the overall Europe 2020 strategy for smart, sustainable and inclusive growth. It proposes 101 specific policy actions across 7 domains: digital single market; interoperability and standards; trust and security; fast and ultra-fast Internet access; research and innovation; digital literacy, skills and inclusion; and ICT-enabled benefits for EU society. This combined set of actions is designed to stimulate a virtuous circle of investment in and usage of digital technologies. The DAE Scoreboard assesses progress with respect to the targets set out in the Digital Agenda. In addition, it provides analysis and detailed data on all the policy areas covered by the Digital Agenda (https://ec.europa.eu/digital-agenda/en/scoreboard).

210 The DAE restates the objective to bring basic broadband to all Europeans by 2013 and sets targets for the deployment and take up of fast and very fast broadband by 2020, namely to ensure that: all Europeans have access to much higher Internet speeds of above 30 Mbps; 50% or more of European households subscribe to Internet lines above 100 Mbps.

3.2 Is there one identified leader for the design and implementation of the DAE policy framework, or many? Who is taking the lead? Are institutionalised coordination mechanisms foreseen among different ministries and different level of government (national and regional) and/or triple or, preferably, quadruple helix partnership platforms?[211] Do these latter groups have decision making power or are they merely to be consulted?

3.3 How will stakeholders be involved during the implementation stage of the DAE policy framework?

3.4 Has this process been adequately described or referred to in the submitted document?

3.5 Is the priority-setting in the DAE policy framework based on an identification of market opportunities/economic potential informed by an entrepreneurial search/discovery process, i.e. by a process designed to identify and test specific entrepreneurial opportunities in ICT where relevant entrepreneurial stakeholders are observed, consulted and involved?[212]

4. Does the DAE policy framework set innovation and knowledge-based development priorities in ICT?

4.1 Does the DAE policy framework outline a limited set of innovation and ICT-driven development priorities?

4.2 Does the DAE policy framework propose a vision for the region for each of the identified priorities? Is this vision clearly described, credible and realistic?

4.3 Does the analysis explore ICT as both an enabling factor and as an area of prioritised specialisations?

4.4 Does the DAE policy framework envisage developing ICT products and services, e-commerce and enhancing demand for ICT and strengthening ICT applications for e-government, e-learning, e-inclusion, e-culture and e-health, or another ICT area?

4.5 Does it explore how ICT can work as an enabler of traditional industries or upgrade these?

4.6 Does the DAE policy framework encompass or refer to a national or regional Next Generation Networks (NGN) Plan?

4.7 Are these priorities sufficiently specific in identifying existing/potential niches for smart specialisation and related upgrading of existing activities or potential future activities? To what extent are they unique?

4.8 Do the thematic priorities chosen in the DAE policy framework reflect the description and analysis of the regional economic structure, competences and skills in ICT?

4.9 Does the DAE policy framework take into account considerations for achieving critical mass and/or critical potential in the priority areas selected?

5. Does the DAE policy framework develop a roadmap, actions and an adequate policy mix to achieve the outlined objectives?

5.1 To what extent does the DAE policy framework contain realistic and adequate roadmaps, action lines and policy mix to achieve the objectives?

5.2 Does the DAE policy framework indicate the division of responsibilities between private, public actors (at different levels and with different areas of responsibility), academia and NGOs for the implementation of these action lines/ roadmaps?

5.3. Does the DAE policy framework support/facilitate the following? Please specify.

- Affordable, good quality and interoperable ICT-enabled private and public services;
- Increased ICT uptake by citizens, including vulnerable groups, businesses (esp. SMEs) and public administrations;
- EU wide initiatives within ICT, such as enhancement of standards and inter-operability;
- Both demand for and supply of ICT in a sustainable way;
- Activities to reach the EU high-speed Internet access targets (Next Generation Networks). Are these based on sustainable investment models that enhance competition and provide access to open, affordable, quality and future proof infrastructure and services that take into account technological neutrality, EU competition and state aid rules, and provision of accessible services to vulnerable groups?
- Improvement of demand-side conditions and, in particular, public procurement as a driver for innovation;
- If applicable, ways to reinforce ICT capacity-building and skills development;
- ICT as an enabler of other activity areas: Are there actions for creating linkages between ICT and other sectors/ disciplines/industries/clusters? Are there activities to support SMEs and traditional sectors through an increased use of ICT?

211 Triple helix platforms bring together academia and research institutes, business and government, while quadruple helix platforms enlarge this circle of actors to include representatives from civil society and citizen groups.

212 In this context entrepreneurial search or discovery is to be understood broadly, as a combinatorial process that is not confined to the private sector, but is a synthesis and integration of dispersed and fragmented global and local knowledge (technological, business and societal) to inform RIS3 choices and identify opportunities for the region to expand/ into new domains.

- [If necessary, add sector/theme specific actions/policies from DG CONNECT pilot notes.]

5.4 To what extent does the DAE policy framework include a sufficiently balanced mix of soft innovation support services and financial instruments? How is the mix of grants, loans and financial engineering (venture capital) structured? Is it appropriate to meet the objectives?

5.5 In which ways does it foster internationalisation of SMEs and external linkages of regional clusters/initiatives?

5.6 Will there be cooperation with other regions within the DAE policy framework? Please describe in which ways, e.g. through mainstream Structural and Investment Funds and/or cooperation through INTERREG and other networks.

6. Does the DAE policy framework produce synergies between and alignment of different policies and funding sources, including, private sector, regional, national and EU-level?

6.1 Are there measures to stimulate private R&D&I investments, for instance through public-private partnerships? Is there a financial commitment of the private sector to the DAE policy framework?

6.2 Does the DAE policy framework describe budgetary sources and indicative budget allocations? Please specify.

6.3 Is the DAE policy framework based on inter-departmental/inter-ministerial/inter-agency coordination for relevant policies, in particular between research/science and economic policies, but also with regard to other relevant areas such as education, employment and rural development policies, as well as important DAE areas like health, security and transportation? Does it take into account the existing level of policy coordination within the region/country?

6.4 Is the DAE policy framework and its priority-setting complementary to national-level priorities, for example. is it in line with the National Reform Programme and existing innovation or digital programmes, also in the above mentioned policy areas? Please specify.

6.5 Please describe how the DAE policy framework envisages synergies between different European, national and regional funding sources, in particular between ERDF and Horizon 2020 but also with other key programmes such as ESF, EAFRD, COSME, JEREMIE, Connecting Europe Facility, ENIAC, ARTEMIS JTIs, Factories of the Future, Green Cars initiatives, EIT KICs and Labs and knowledge regions?

7. Does the DAE policy framework set achievable goals and measure progress? How does it support a process of policy learning and adaptation?

7.1 To what extent does the DAE policy framework outline an adequate system for monitoring and evaluation? Please specify.

7.2 Does the document identify concrete, achievable goals? Does it identify output and result indicators and a realistic timeline for these goals?

7.3 Does the DAE policy framework foresee the measurement of progress in the relevant areas which are aligned with existing relevant sectoral EU, national or regional DAE-relevant priorities?[213] Does it entail measurements of the progress of ICT use and its impact (e.g. productivity gains) at national or regional level? Does it use the same indicators as those used by the DAE Scoreboard? Does it contain additional country/region specific indicators to track progress of the implementation measures?[214]

7.4 Does the region have a governance mechanism in place to react and act upon findings from the monitor and evaluation system? Does this support a process of continuous policy learning and adaptation? If not, are actions foreseen to build up capabilities for that?

7.5 Is there a communication plan to reach out to stakeholders and the general public? To what extent does the DAE policy framework develop mechanisms to generate support from and the active participation of vital groups for the implementation?

8. What are the conclusions and which advice can be given to improve the DAE policy framework?

8.1 If the DAE policy framework is based on an earlier document, has it been appropriately reviewed and updated? What is going to be done differently as a consequence of the DAE policy framework and process compared to the previous document?

8.2 Can this DAE policy framework address digital growth to stimulate affordable, good quality and interoperable ICT-enabled private and public services and increase uptake by citizens, including vulnerable groups, businesses and public administrations including cross border initiatives? What are its strong aspects? What are its weaker parts?

8.3 What needs to be changed? Feel free to add any other comment you may have that could help the country/region to improve its DAE policy framework within the RIS3 process.

213 If the DAE policy framework is part of a national or regional RIS3, its monitoring should be carried out as part of the monitoring of this framework.

214 The monitoring mechanism should take into account key indicators of the DAE Scoreboard but can contain additional indicators to track the progress of the implementation measures.

Appendix 2: Glossary

4G	4G is the fourth generation of mobile phone mobile communications standards, aka: Long Term Evolution Advanced (LTE-A) and Wimax 2 (or Wireless MAN-Advanced). This will increase speed and capacity for data transfer.
AAL **Active Assisted Living; Active Ageing**	(A combination of) intelligent systems of assistive products and services, integrated in the preferred living environment, to constitute 'intelligent environments' to compensate predominantly age-related functional limitations and support an independent, active and healthy course of life.
Accelerators	Accelerators are modern, for-profit start-up incubators. They target start-ups consisting of small teams and provide funding, mentoring, training and events for a limited period (usually 3 months), in exchange for equity. While traditional business incubators are often government-funded, generally take no equity, and focus on biotech, medical technology, clean tech or product-centric companies, accelerators are privately-funded.
ARTEMIS	ARTEMIS is a Joint Technology Initiative for embedded computing systems. It aims to help industry to consolidate and reinforce European world leadership in this field. The ARTEMIS Joint Undertaking aims to achieve effective coordination and synergy of resources and funding from the industry, the Framework Programme, national R&D programmes and intergovernmental R&D schemes.
Authentication	An electronic process that allows the validation of the electronic identification of a natural or legal person; or of the origin and integrity of an electronic data.
Backhaul	The middle part of a broadband network, connecting the local access to the core internet network. Technically the link from the cable head to the international switching centre.
Bandwidth	Bandwidth is the capacity of a network or other communication channel for transferring data, measured in bps.
Broadband	A term applied to high speed telecommunications systems, i.e. those capable of simultaneously supporting multiple information formats such as voice, high-speed data services and video services on demand. The Digital Agenda defines three levels of broadband speeds: 2, 30, and 100 Megabit per second.
Broadband Guidelines on State Aid	In December 2012, new rules on state aid for broadband were adopted. Main changes are the need for a step change, i.e. a substantial improvement of broadband coverage as a result of aid, Aid for minor improvements is excluded. Under strict conditions aid for ultrafast broadband in under-served areas, is eligible. The new rules include a technology neutral definition for fixed wireless access solutions to fall under the definition of next generation access .

CEF **Connecting Europe Facility**	The digital support from the Connecting Europe Facility (CEF) proposed by the Commission at EUR 1bn at the February 2013 European Council. The major part of the funding will be used to facilitate the mobility of citizens and businesses by providing seamless cross-border public services. The CEF will only be able to provide seed funding for a limited number of broadband projects, together with the European Investment Bank and limited technical assistance for projects seeking support from CEF or Structural Funds, or both. Projects that will benefit directly from CEF will need to demonstrate state-of-the-art technological solutions and represent either innovative business models or highly replicable solutions.
CEF-DSI **Connecting Europe Facility** **Digital Services Infrastructure**	Digital Services Infrastructure (DSI or CEF-DSI) refers to the part of the CEF funding that would support public interest digital service infrastructure such as electronic health records, electronic identification and electronic procurement.
CII **Critical Information Infrastructure**	CII is all "ICT systems that are critical infrastructures for themselves or that are essential for the operation of critical infrastructures (telecommunications, computers/software, Internet, satellites, etc.)".
CIP **Competitiveness and Innovation Framework Programme**	The Competitiveness and Innovation Framework Programme (CIP) supports innovation activities with three main priorities: (1) wider access and better use of ICT, (2) increased use of renewable energies and energy efficiency, and (3) eco-innovation. The programme also provides better access to finance and delivers business support services in the regions.
Cloud networking	The research area of cloud networking refers to the networking aspects of cloud computing and as such comprises mechanisms to introduce key cloud properties elasticity, scalability, and flexibility of resources into the network in order to distribute content, (cloud) applications, and (cloud) services efficiently. It also refers to combined on-demand management and control of computing, storage and connectivity resources in the network, in order to provide cloud-like services with network resources as opposed to big centralised data centres, i.e. the Telco cloud.
Cloud computing	Cloud computing is a model for enabling convenient on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Users do not need to invest in their own infrastructures. Storage and processing takes place in the cloud rather than at the user premises or on the user devices. Cloud services can rapidly scale up or down according to demand, giving the "illusion of unlimited resources". Computing becomes an operating rather than a capital expenditure item. See also Grid computing and Distributed computing.
Cross-border digital public services	Cross-border Digital Public Services are eGovernment services which are a) provided by or on behalf of European public sector entities; b) at local, regional, national, or supra-national level; c) by means of interoperable trans-European telematic networks; d) in order to perform public administration tasks; e) that are capable of meeting a service demand of public entities, citizens, and/or businesses other than those which are native to the public sector entity's geographic level through nationality, registration or incorporation.
Crowdfunding	Crowdfunding can be defined as a collective effort by many individuals who network and pool their resources to support efforts initiated by other people or organisations. This is usually done via or with the help of the Internet. Individual projects and businesses are financed with small contributions from a large number of individuals, allowing innovators, entrepreneurs and business owners to utilise their social networks to raise capital.

Cyber-security	Cyber-security commonly refers to the safeguards and actions that can be used to protect the cyber domain, both in the civilian and military fields, from those threats that are associated with or that may harm its interdependent networks and information infrastructure. Cyber-security strives to preserve the availability and integrity of the networks and infrastructure and the confidentiality of the information contained therein. The term cyber-security also covers prevention and law enforcement measures to fight cybercrime.
DAITF Data Access and Interoperability Task Force	DAITF is a new international initiative for Data Initiated in Europe, DAITF aims to create an open forum for discussion and agreement on data-related standards, APIs, policy rules, and data interoperability mechanisms, from the very basic integration layers (AAI, PIDs, registries, etc.) to the semantic and regulatory levels. DAITF will integrate its bottom-up activities under the RDA (Research Data Alliance) governance structure.
DAE Digital Agenda for Europe / DAE Review	The Digital Agenda for Europe (DAE) was adopted in 2010 as an integral part of the Europe 2020 strategy, to stimulate the digital economy and address societal challenges through ICT. Two years after its adoption, the DAE has delivered. 40% of the targets have been met. The review of Digital Agenda was adopted on 18th December 2012. It refocuses the DAE to better stimulate the digital economy through mutually enhancing and complementary measures in the following key areas: advancing the European borderless digital economy; speeding up structural reforms of public services; stimulating private investment in high-speed fixed and mobile broadband networks; fostering a secure and trustworthy internet environment; establishing a coherent framework for the development and use of cloud computing; creating a favourable environment for business and entrepreneurs; implementing research and innovation policy for industrial competitiveness based on funding key enabling technologies.
Digital Agenda Scoreboard	The Digital Agenda Scoreboard assesses progress with respect to the targets set out in the Digital Agenda. In addition, it provides analysis and detailed data on all the policy areas covered by the Digital Agenda.
Digital Champions	Appointed by EU Member States following a request of President Barroso (14 February 2012). The primary task of DCs is to work with citizens, communities and businesses to exploit the growth potential of the digital economy. They can do this by helping individuals to enhance their IT skills, by ensuring that the public sector becomes more efficient and customer-friendly and by helping businesses to embrace new technologies which will allow them to be more productive and competitive at home and across borders. By ensuring regular contact between the Champions, the European Commission provides a platform to discuss and compare action at grass-roots level, and mobilises citizens and businesses to take advantage of the digital economy.
Digital divide	The digital divide is the gulf between those parts of the population that have access to the internet and other digital technologies, and those sections of the population that do not. There is concern that as so many services (both commercial and governmental) become available online, groups without digital access (caused by, among other things, high cost, lack of skills, location, or a combination of these) will be left behind, and miss out on opportunities in life and in work.
Digital libraries	Digital libraries are organised collections of digital content made available to the public. The content is material that has either been digitised (copies of books and other documents) or that was initially produced in digital format.
Digital rights management	DRM systems work by identifying digital content that contains intellectual property. They enable right holders to enforce their rights in the digital environment and allow the management of rights and payments in a wide sense.

Digital science	Digital science is about the way research is carried out, disseminated, deployed and transformed by digital tools, networks and media. These issues are often also covered by concepts such as e-Science, e-Infrastructures, open science, science2.0, web science, or internet science. Digital science relies on the combined effects of technological development and cultural change towards collaboration and openness in research. Digital science makes scientific processes more efficient, transparent and effective by new tools for scientific collaboration, experiments and analysis and by making scientific knowledge more easily accessible. At the same time, Digital science enables the emergence of new scientific practices, disciplines and paradigms to respond to the new challenges through global distributed collaborations where citizens and society participate as contributors and direct beneficiaries of scientific knowledge.
Digitisation of cinemas & cultural material	Digital technologies are increasingly used by filmmakers. New cameras and formats make it easier to produce films. Other digital tools are being used for exciting special effects and 3D films. Distributing a digital film copy can be up to ten times cheaper than a traditional 35mm print; digital cinema could therefore make it easier for European films to be seen by global audiences. However digital screening equipment can cost too much, therefore, in Europe theatrical distribution (cinemas) is just starting to move towards digitisation.
eCommerce	eCommerce (electronic commerce) is a generic term used to describe trade over the internet. The activities concerned include selling goods online, offering online information or commercial communications, providing tools allowing for search of products and services, access and retrieval of data. According to the e-commerce Action Plan from January 2012, the growth rate of e-commerce at national level is high but this new vector remains marginal at only 3.4% of European retail trade. It is less advanced than in the United States or Asia-Pacific and tends not to go beyond national borders; cross-border activity remains low. The Digital Agenda for Europe sets targets for e-commerce performance which are defined as: 50% of population should be buying online by 2015. 20% of population should be buying online at cross-border by 2015 and 33% of SMEs should conduct online purchases by 2015. There is no legal definition of the term “e-commerce” in EU law; however, the e-commerce directive (2000/31/EC) refers to the definition of “information society services” provided in directive 98/34/EC (see the relevant term below).
eGovernment	eGovernment is about using the tools and systems made possible by Information and Communication Technology tools and systems to provide better public services to citizens and businesses. ICT is already widely used by government bodies, just as in enterprises, eGovernment involves much more than just the tools; effective eGovernment also involves rethinking organisations and processes, and changing behaviour so that public services are delivered more efficiently to the people who need to use them. Implemented well, eGovernment enables all citizens, enterprises and organisations to carry out their business with government more easily, more quickly and at lower cost.
eHealth	eHealth, also known as ‘ICT for Health’, is a term for healthcare practice which is supported by electronic processes and communication. Examples include health information networks, electronic health records, telemedicine and telecare services, wearable and portable systems and decision support systems. eHealth solutions have been shown to improve disease prediction or prevention, diagnosis, treatment, disease and lifestyle management. When combined with proper organisation and skills, eHealth has the potential to be a critical tool for enhancing the sustainability of health delivery systems, patient safety and personalised care.

eInclusion	eInclusion or digital inclusion is the term used within the European Union to encompass activities related to the achievement of an inclusive information society. In this vein, new developments in technology turn the risk of a digital divide into "digital cohesion" and opportunity, bringing the benefit of the Internet and related technology into all segments of the population, including people who are disadvantaged due to education (a specific subset called e-Competences), age (called e-Ageing), gender, disabilities (called e-Accessibility), ethnicity, and/or those living in remote regions (subject to the geographical digital divide). eInclusion mainly covers the development of appropriate policies, maintenance of a knowledge base, research and technology development and deployment, & best practices dissemination.
e-Infrastructures	e-Infrastructure denotes the comprehensive ICT infrastructure that is needed to enable the complex, multi-disciplinary and globalised practice of modern science. It capitalises on advances in ICT and integrates hardware for computing, data and networks, observatories and experimental facilities, and an interoperable suite of software and middleware services and tools. Such an infrastructure is necessary in science today to address the need to store, analyse and process unprecedented amounts of (heterogeneous in general) data and information, to enable world-scale scientific collaborations and the access to and sharing of scientific resources and information regardless of their type and location in the world.
ENIAC	The ENIAC Joint Undertaking (JU) was created in February 2008 in order to implement a Joint Technology Initiative (JTI) on nanoelectronics - a research programme aimed at enhancing the further integration and miniaturisation of devices and increasing their functionalities. The ENIAC JU is set up as a public-private partnership, bringing together the European Commission and European Member and Associated States with AENEAS, the association representing the R&D actors in nanoelectronics (corporate, SMEs, research institutes and universities) in Europe.
ENISA **European Network and Information Security Agency**	ENISA was created following the adoption of Regulation (EC) No 460/2004 of the European Parliament and of the Council on 10 March 2004 "for the purpose of ensuring a high and effective level of network and information security within the Community and in order to develop a culture of network and information security for the benefit of the citizens, consumers, enterprises and public sector organisations of the European Union, thus contributing to the smooth functioning of the internal market".
ENoLL **European Network of Living Labs**	The European Network of Living Labs creates a platform where firms, public authorities and citizens can work together on developing and testing new technologies, business models and services in real-life contexts. The ultimate aim is to set up a new European Innovation Infrastructure where users play an active role in innovation.
eParticipation	eParticipation refers to ICT-supported participation in processes involved in government and governance. Processes may concern administration, service delivery, decision making and policy making. In other words eParticipation refers to all ICT-supported democratic processes except e-voting.
eProcurement	eProcurement refers to the use of electronic communications by public sector organisations when buying supplies and services or tendering public works.

ESIF **EU Structural and Investment Funds**	The European Commission decided that cohesion policy, rural development and maritime and fisheries policies should remain essential elements of the 2014-2020 financial package because of their pivotal role in delivering the Europe 2020 Strategy. Hence, it proposed that structural policies should concentrate funding on a smaller number of priorities strongly linked to the Europe 2020 strategy, focusing on results, monitoring progress towards agreed objectives and simplifying delivery. The Commission has proposed a Regulation covering all structural policy funding instruments under the term ESIF. The first part of the proposal sets out common rules governing the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development (EAFRD), and the European Maritime and Fisheries Fund (EMFF). It will increase coherence amongst the instruments for better synergies and greater impact. The second part sets out common rules governing the three main funds delivering the objectives of cohesion policy: the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund (CF).
eSkills	eSkills or electronic skills include those needed to make use of ICT as well as those required to apply and develop them. The European e-Skills Forum defines the term "e-Skills" as covering three main Information and Communication Technologies (ICTs) categories: 1) ICT practitioner skills, 2) ICT user skills, 3) eBusiness skills.
EIP **European Innovation Partnership**	A partnership supporting the European Innovation Union, breaking down silos and bringing together all relevant stakeholders across policies, sectors and borders to speed up innovations that address a major societal challenge, and gain competitive advantage for growth and job creation in Europe. EIPs are organised around concrete and ambitious targets, agreed at political level, in areas of societal challenges that command broad public and political support. For the European Innovation Partnership on Active and Healthy Ageing, see http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing.
European Semester	The European Commission has set up a yearly cycle of economic policy coordination called the European Semester. Each year the European Commission undertakes a detailed analysis of EU Member States' programmes of economic and structural reforms and provides them with recommendations for the next 12-18 months. The European Semester starts when the Commission adopts its Annual Growth Survey, usually towards the end of the year, which sets out EU priorities for the coming year to boost growth and job creation.
Europeana	Europeana is a search platform for a collection of European digital libraries with digitised paintings, books, films and archives. The project was initiated by the European Commission. The prototype contained around two million digital items, all of them already in the public domain.
FET **Future and Emerging Technologies**	FET is the incubator and pathfinder for new ideas and themes for long-term research that challenges current and mainstream thinking. Its mission is to promote high risk research offset by potential breakthrough with high technological or societal impact. Building on the success of the FET programme under FP7, FET constitutes a key element of the Excellent Science priority of Horizon 2020.
GÉANT	Advanced pan-European backbone network connecting National Research and Education Networks (NRENs) across Europe totalling more than 50,000km in length. GÉANT offers unrivalled geographical coverage, high bandwidth and innovative hybrid networking technology. GÉANT offers European academics and researchers high speed, private network connection to other research centres.

Grid computing	A grid is a service for sharing computer power and data storage capacity over the Internet. It goes well beyond the connection between computers and ultimately aims to turn the global network of computers into a vast computational resource for large-scale computer- and data-intensive applications. In grid computing, users harness computing power from resources owned by many different institutions and organisations that have selected to make them available to others. These resources may be scattered over a wide geographic area — even globally — and comprise processing power, data storage capacity, sensors, visualisation tools and more. Grid computing brings these resources, thousands of them in some cases, together into a common, shared infrastructure, linked over networks via a common set of middleware.
Guide to Broadband Investment	The Guide, issued by the European Commission in 2011, is aimed at assisting management authorities of EU funds to plan and implement broadband projects financed in the context of EU regional and rural development policies. The guide is structured around seven questions concerning policy, regulatory, investment and technological issues including the pros and cons of five different investment models for efficient and effective public-sector interventions in next-generation broadband access networks.
Guide to Research and Innovation Strategies for Smart Specialisation	This guide, issued by the European Commission in 2012, is targeted at ESIF managing authorities, policy-makers and regional development professionals. It sets out the concept of smart specialisation and provides orientations on how to develop research and innovation strategies for smart specialisation (RIS3). The guide also presents in a compact form several instruments that could be used to implement Smart Specialisation Strategies, in particular cluster support, university-enterprise cooperation, SME innovation support, centres of competence and research infrastructures, public procurement of innovation etc.
High-speed broadband	High-speed broadband is a broadband service provided through a Next Generation Network (NGN).
Horizon 2020	Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. Running from 2014 to 2020 with a budget of just over EUR 70 billion, the EU's new programme for research and innovation is part of the drive to create new growth and jobs in Europe. It provides major simplification through a single set of rules. It will combine all research and innovation funding currently provided through the Framework Programmes for Research and Technical Development, the innovation-related activities of the Competitiveness and Innovation Framework Programme (CIP) and the European Institute of Innovation and Technology (EIT).
HPC High-performance computing	HPC (or supercomputing) denotes high speed tera- and peta-scale (advancing towards exa-scale) computing implemented as a cluster of multiple processors, sometimes thousands, harnessed together via fast communications pipelines and cluster software. Supercomputing e-Infrastructures enable tackling the data-intensive and complex challenges of modern science with new computing and simulation capabilities.
Internet	A global system of interconnected computer networks that interchange data by packet switching using the standardised Internet Protocol Suite (TCP/IP).
IoT Internet of Things	'Internet of Things' (IoT) is a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes and virtual personalities and use intelligent interfaces and are seamlessly integrated into the information network.
Interoperability	Interoperability concerns the ability of systems, devices, components or services to exchange information and to use that information.

JTI **Joint Technology Initiative**	In a limited number of cases, the scope of the RTD objectives and the resources involved justify setting up long-term public-private partnerships in the form of "Joint Technology Initiatives" (JTIs). JTIs aim to achieve greater strategic focus by supporting common ambitious research agendas in areas that are crucial for competitiveness and growth, assembling and coordinating at European level a critical mass of research. They therefore draw on all sources of R&D investment - public or private - and couple research tightly to innovation.
KETs **Key Enabling Technologies**	KETs are "knowledge intensive and associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly skilled employment. They enable process, goods and service innovation throughout the economy and are of systemic relevance. They are multidisciplinary, cutting across many technology areas with a trend towards convergence and integration. KETs can assist technology leaders in other fields to capitalise on their research efforts" (COM(2009)512). The Commission selected the following KETs as a priority for Europe: nanotechnology, micro- and nanoelectronics including semiconductors, advanced materials, biotechnology and photonics (COM(2012)341). KETs provide indispensable technology bricks that enable a wide range of product applications, including those required for developing low carbon energy technologies, improving energy and resource efficiency, boosting the fight against climate change or allowing for healthy ageing. In 2012, the ICT Advisory Group produced a report highlighting the role of software technologies, to be considered as priority KETs for Europe.
KPIs **Key Performance Indicators**	Indicators which measure the level of performance in the provision of the relevant wholesale services by regulated operators to access seekers.
Living labs	Through partnerships between citizens, businesses and public authorities, the living labs model allows people and industries to test tomorrow's best innovations in ICT. The living labs model includes end-user participation from an early stage of the creative process of technology development. As a result, evaluating aspects such as social and economic implications of new technologies has become more accurate. So the needs of users are better listened to and fulfilled.
NRA **National Regulatory Authority**	The body or bodies charged by a Member State with any of the regulatory tasks assigned in the regulatory framework for telecommunications.
NGA **Next Generation Access**	Access networks which consist wholly or in part of optical elements and which are capable of delivering broadband access services with enhanced characteristics (such as higher throughput) as compared to those provided over already existing copper networks. In most cases NGAs are the result of an upgrade of an already existing copper or co-axial access network.
NIS **Network and Information Security**	Ability of a network or an information system to resist, at a given level of confidence, accidental events or malicious actions. Such events or actions could compromise the availability, authenticity, integrity and confidentiality of stored or transmitted data as well as related services offered via these networks and systems.
Open access	Open access can be defined as the practice of providing on-line access to scientific information that is free of charge to the reader. 'Scientific information' refers to two main categories: peer-reviewed scientific research articles (published in academic journals), and – scientific research data (data underlying publications and/or raw data). The key argument in favour of open access is that modern research builds on extensive scientific dialogue and advances by improving earlier work. Fuller and wider access (through open access) to scientific publications and data will therefore help to: accelerate innovation (faster to market = faster growth); foster collaboration and avoid duplication of effort (greater efficiency); build on previous research results (improved quality of results); involve citizens and society (improved transparency of the scientific process).

Open data	Free and wide availability of data for consultation and re-use, with a view to increasing transparency and stimulating economic activity. Applies mostly, but is not strictly limited to government data.
Open innovation	Open innovation is related to crowdsourcing and co-creativity between various actors in the innovation process including the user. In contrast, closed innovation refers to processes that limit the use of internal knowledge within a company and make little or no use of external knowledge.
PPP	Public Private Partnerships
PPC	In other cases, the required improvements are so technologically demanding that there are no near-to-the-market solutions yet, and new R&D is still needed to prove that the market can really deliver commercially stable solutions with the desired price / quality requirements before procurers can commit to buy large volumes of end-solutions. Typically in such a case there are different potential suppliers proposing alternative competing solution approaches, but there is no conclusive test evidence yet which of the approaches will finally deliver the best value for money solution. This is when Pre-Commercial Procurement (PCP) can be used effectively.
PPI	In some cases, the required improvements can be addressed by solutions that are already or nearly on the market and don't require any new R&D. Solutions have typically been tested on a small scale but what lacks is early adopters that commit to procure a critical mass of end-products, to create the incentive for industry to scale up its production chain and make some final products adaptations to meet the end-users' price / quality requirements for large scale deployment. This is when Public Procurement of Innovative solutions (PPI) can be used effectively.
PSI **Public sector information**	Data produced and collected by public bodies (digital maps, meteorological, legal, traffic, financial, economic and other data). Most of this raw data could be re-used or integrated into new products and services which we use on a daily basis, such as car navigation systems, weather forecasts, financial and insurance services. A proposal to open re-use of such information is presently under discussion.

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Abstract
The Digital Agenda Toolbox provides support to regional and national authorities to develop a thorough understanding of the digital growth potential stemming from the Digital Agenda for Europe (DAE). It highlights the opportunities Information and Communication Technology (ICT) entails as a key element in their national or regional research and innovation strategies for smart specialisation (RIS3) and related Operational Programmes (OPs). At the same time, this Toolbox provides guidance for the fulfilment of the DAE-related ex-ante conditionalities that will form the basis for using European Regional Development Funds (ERDF) for ICT investments. It thus complements the RIS3 Guide and other related policy documents such as the Guide on Broadband Investment. The Toolbox furthermore provides hands-on assistance for developing a strategic policy framework for digital growth by discussing the dos and don'ts of the process and giving examples of good practises.

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